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Republic of the Philippines
Department of Environment and Natural Resources
Provincial Environment and Natural Resources Office
REGION IV-B (MIMAROPA)
Suqui, Calapan City, Oriental Mindoro

August 13, 2014

MEMORANDUM

FOR	:	The Regional Director MIMAROPA Region 1515 L&S Building, Roxas Blvd., Manila
FROM	:	The OIC- PENR Officer Oriental Mindoro
SUBJECT	:	**SUBMISSION OF COPY OF CHARACTERIZATION OF THE MAG-ASAWANG TUBIG WATERSHED.**

Respectfully forwarded is the Memorandum of the OIC,CENRO Socorro submitting the Characterization of Mag-asawang Tubig Watershed having an area of **43, 534.24** hectares covering the Municipalities of Victoria and Naujan, Oriental Mindoro and Sablayan, Oriental Mindoro.

The characterization activity was undertaken by the Watershed Management Staff of CENRO Socorro with the assistance of the Technical Staff of this Office in accordance with the guidelines stipulated under DMC 2008-05, series of 2008.

For his information and record.

maryj

MARY JUNE F. MAYPA

Republic of the Philippines
Department of Environment and Natural Resources
MIMAROPA REGION
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MEMORANDUM

PENRO RECEIVED 08-05-14 DATE Calapan, Oriental Mindoro

FOR : The OIC Regional Director

THRU : The OIC PENRO

FROM : The In-Charge, Office of the CENRO

SUBJECT : COPY OF THE CHARACTERIZATION OF MAG-ASAWANG TUBIG WATERSHED AREA.

DATE : July 31, 2014

Respectfully forwarding herewith the final copy of the Characterization of Mag-asawang Tubig Watershed area following the guidelines stipulated in DMC 2008-05 series of 2008.

Please be informed that preparation of Management Plan for Mag-asawang Tubig Watershed area is on-going and shall be submitted as soon as completed.

For his information, evaluation and record.

LEO G. CAPON

CHARACTERIZATION OF MAG-ASAWANG TUBIG WATERSHED AREA

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
CENRO SOCORRO, ORIENTAL MINDORO
JUNE 30, 2014

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CHARACTERIZATION OF MAG-ASAWANG TUBIG WATERSHED AREA

I. INTRODUCTION AND BACKGROUND INFORMATION

A. SCOPE AND RATIONALE

Watershed is a catchment basin but not necessarily upland or mountainous, there are also those located in the lowland area (Cruz,1999).

Seventy percent (70%) of our country's total land area can be classified as watershed (Francisco and Rola,2004). These watershed areas supply the irrigation, hydro electric power plant and water for industrial and domestic needs of the people.

In fact some 1.5 million hectares of our agricultural lands are deriving water from the watershed (Pulhin et al 2006).

A healthy watershed area has a good cover of vegetation. These requirements assured the supply of water even during the hottest period of the year. The thick forest cover also delayed the concentration of water downstream due to the fact that the rainfall are being retained by the trees thereby slowing the movement of water downward and avoiding floods to the low lying areas. This situation help to avoid destruction to the lives and property of many people.

Today our watershed areas are suffering from further degradation due to unhampered human activities such as illegal logging ,kaingin-making and upland migration. Watershed degradation lead to disturbance and landscape fragmentation that causes species to be isolated from one another(Tiwarai et.al. 2008). These meta-populations along the sloping areas are now put into critical positions and therefore reproduction of important species will be affected(Roy et al. 2008). While soil degradation is causing lost of nutrients and other important elements vital to the growth and development of plants and animals in the forestland (Asio et. al 2009). As such changes in the land cover effects the flow or supply of water to the river system (Mustafa et al 2005).Not only the supply of water is being affected by the watershed destruction, there are climate changes also detrimental to human existence (Lasco, et. al. 2006).

B. ROLE OF THE WATERSHED AREA

Both the natural and manmade forests are providing critical role in the watershed areas in providing supply of water to human being(Locatelli et. al. 2009). But aside from supplying water to the residents and people nearby, this give also many benefits such as those livelihood opportunities for others. Multiple functions and uses of watershed should be protected, conserved and harness to sustain the benefits this area gives to the people.

C. CAUSES OF WATERSHED DESTRUCTION

The present cause of watershed destruction is believe to be the poverty. The lack of opportunity in the lowland forced many people to migrate to the upland areas and convert the area into agricultural uses just to eke out for a living. This type of agricultural practices of the upland dwellers are too destructive to the soil stability therefore there is a need to value the soil conservation, biological diversity is needed to be preserved in the area and at the same time help preserved the forests as a whole (Pattanayak et. al.1997, Ghouzhdi,H.G. 2010).

D. CHARACTERIZATION OF THE WATERSHED

Characterization study of watershed to determine its attributes is an important development for watershed basin. Through the analysis of basin, watershed landscape can be better understood (Parveen et. al. 2012). Prediction of watershed behavior during the intense rainfall can be determine through morphometric analysis. Morphometry is the measurement and mathematical analysis of land features (Parveen et. al. 2012). One of the useful tools in this analysis is by using the Geographic Information System (GIS) because this give the spatial information of the watershed area.

Important watershed attributes that are needed to be determined in characterization are its bio-physical such as climate, physiographic, geology, soils, land-use and hydrology. Socio-economic aspects are needed also to be determined in watershed characterization since that all the benefits derive therein are being used by human populations for their own good.

Geomorphologic characteristics is important also in systematic description of the watershed area. According to Jain and Sinha (2003), Okoko and Olujini (2003) as cited in Ajibadeet. al (2010) geomorphic characteristics of a drainage basins play key role in controlling basin hydrology. These are linear aspect, aerial aspect of drainage basin, and relief aspect of channel network.

One of the main objective of this project is to know the possible threat this watershed area faced both from natural and man-made intervention. Assessment of its vulnerability is needed to know the proper measures that are needed to be taken to conserve, develop and preserve the natural resources found inside this watershed area.

Mag-asawangTubig watershed lies in the mountainous portion of Naujan, Victoria Oriental Mindoro and Sablayan, Occidental Mindoro. This watershed provides irrigation water to low lying area such as rice field in Victoria and Naujan flood plain. It has been observed in Villacerveza that the water flowing from the Mag-asawangtubigriver isdiverted by using river rocks and done throughmanual labor to let the flow of water

pass the irrigation canal going to the ricefield and benefiting the farmers therein(Figure 1).

Figure 1. Forester II Domingo B. Santos pointed to the diverted river going to the rice field.

II. PRESENT STATE OF THE WATERSHED

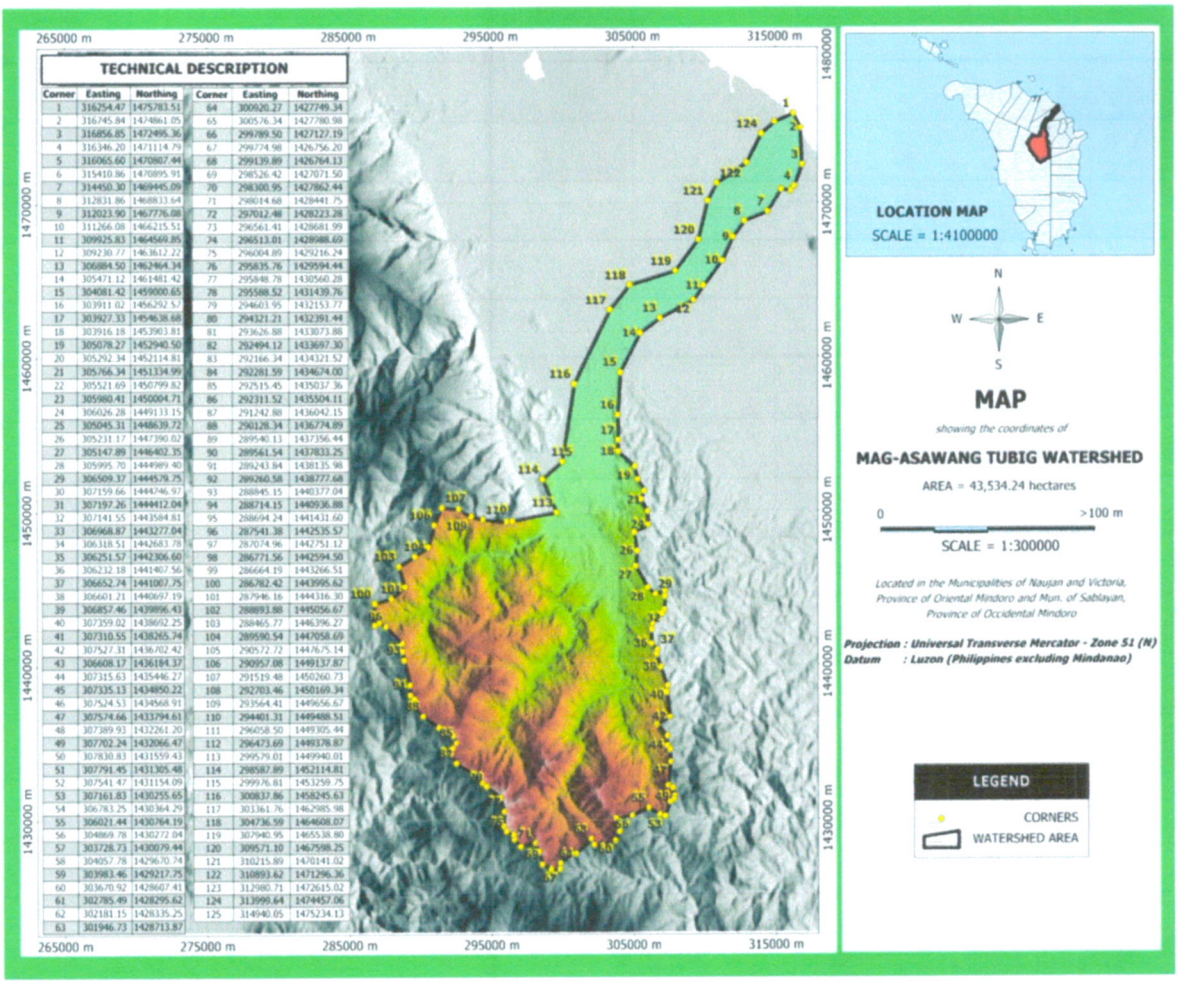
Mag-asawangTubig Watershed like any other watershed is being subjected to human exploitation. A lot of factors are affecting and threaten it's very existence. Some of these are kaingin-making and illegal cutting of trees. Patches of perennial crops such as coconut and lanzones are being observed planted inside the watershed area with communities of people living nearby. It is interesting to note that the gradual decrease of vegetation has a compounding effect in ecological functions of the watershed. These are erosion, siltation sedimentation and the poor storage capacity of the catchment area.

2.1 PHYSICAL ENVIRONMENT

2.1.1 GEOPHYSICAL LOCATION

Mag-AsawangTubig lies between $13^{0}20'33"$ to $12^{0}54'05"$ north latitude and $121^{0}01'47"$ to $121^{0}18'45"$ east longitude (Figure 2).

Figure 2. Location of MagasawangTubig



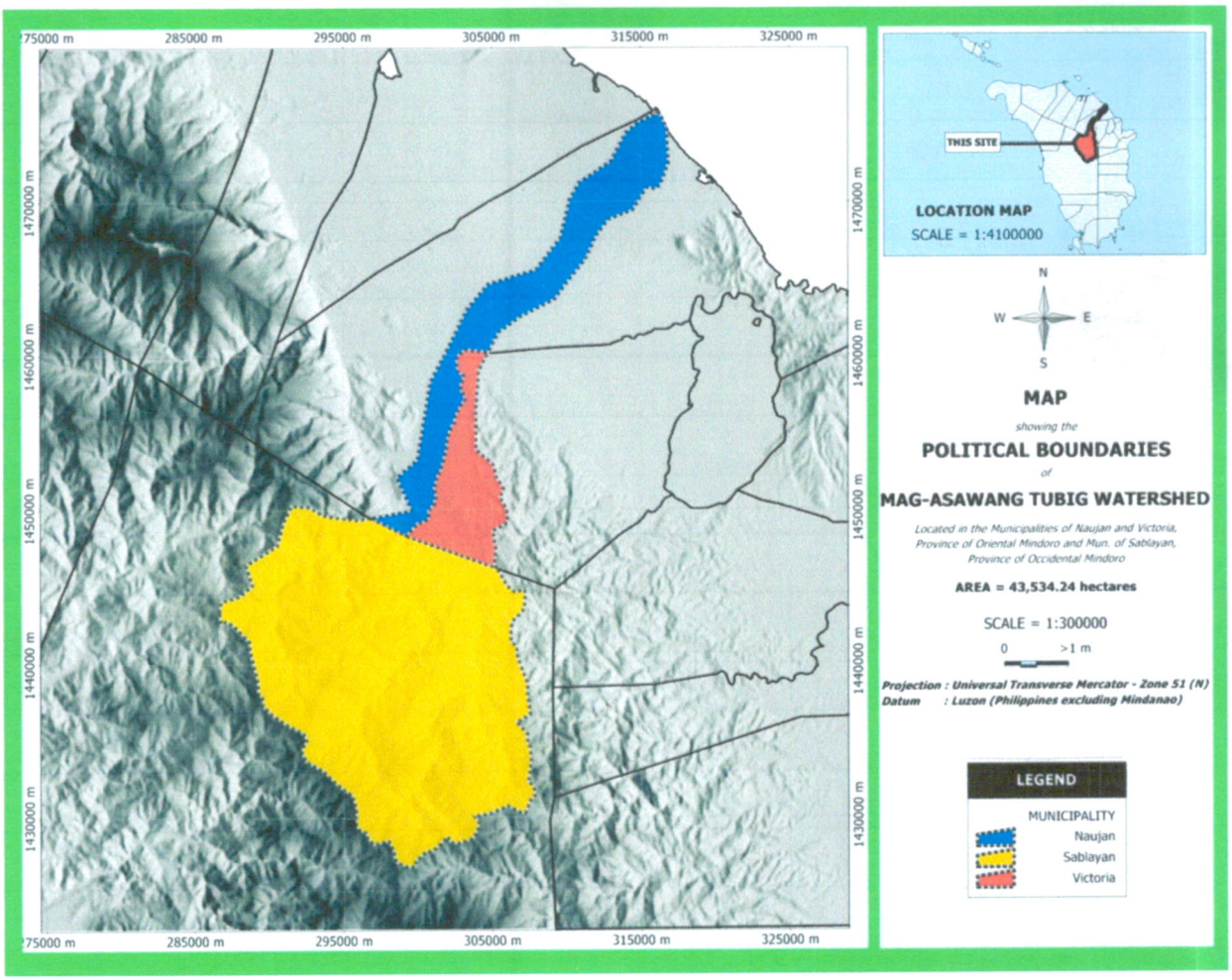
Corner	Easting	Northing	Corner	Easting	Northing
1	316254.47	1475783.51	64	300920.27	1427749.34
2	316745.84	1474861.05	65	300576.34	1427780.98
3	316856.85	1472495.36	66	299789.50	1427127.19
4	316346.20	1471114.79	67	299774.98	1426756.20
5	316065.60	1470807.44	68	299139.89	1426764.13
6	315410.86	1470895.91	69	298526.42	1427071.50
7	314450.30	1469445.09	70	298300.95	1427862.44
8	312831.86	1468833.64	71	298014.68	1428441.75
9	312023.90	1467776.88	72	297012.48	1428223.28
10	311266.08	1466215.53	73	296561.41	1428681.99
11	309925.83	1464569.85	74	296513.01	1428988.69
12	309230.77	1463612.22	75	296004.89	1429216.24
13	306884.50	1462464.34	76	295835.76	1429594.44
14	305471.12	1461481.42	77	295848.78	1430560.28
15	304081.42	1459000.65	78	295588.52	1431439.76
16	303911.02	1456292.57	79	294603.95	1432153.77
17	303927.33	1454838.68	80	294321.21	1432391.44
18	303916.18	1453903.81	81	293626.88	1433073.88
19	305078.27	1452940.50	82	292494.12	1433697.30
20	305292.34	1452114.81	83	292166.34	1434321.52
21	305766.34	1451334.99	84	292281.59	1434674.00
22	305521.69	1450799.82	85	292515.45	1435037.36
23	305980.41	1450004.71	86	292311.52	1435504.11
24	306026.28	1449113.15	87	291242.88	1436042.15
25	305045.31	1448639.72	88	290128.34	1436774.89
26	305231.17	1447390.02	89	289540.13	1437356.44
27	305147.89	1446402.35	90	289561.54	1437833.25
28	305995.70	1444989.40	91	289243.84	1438135.98
29	306509.37	1444578.75	92	289260.58	1438777.68
30	307159.66	1444746.97	93	288845.15	1440177.04
31	307197.26	1444412.04	94	288714.15	1440936.88
32	307141.55	1443584.81	95	288694.24	1441431.60
33	306968.87	1443277.04	96	287541.38	1442535.57
34	306318.51	1442683.78	97	287074.96	1442751.12
35	306251.57	1442306.60	98	286771.56	1442594.50
36	306232.18	1441407.56	99	286664.19	1443266.51
37	306652.74	1441007.75	100	286782.42	1443995.62
38	306601.21	1440697.19	101	287946.16	1444316.30
39	306857.46	1439896.43	102	288893.88	1445056.67
40	307359.02	1438692.25	103	288465.77	1446396.27
41	307310.55	1438265.74	104	289590.54	1447058.69
42	307527.31	1436702.42	105	290572.72	1447675.14
43	306608.17	1436184.37	106	290957.08	1449137.87
44	307315.63	1435446.27	107	291519.48	1450260.73
45	307335.13	1434850.22	108	292703.46	1450169.34
46	307524.53	1434568.93	109	293564.41	1449656.67
47	307534.66	1433794.61	110	294401.31	1449488.51
48	307389.93	1432261.20	111	296058.50	1449305.94
49	307702.24	1432066.47	112	296473.69	1449378.87
50	307830.83	1431559.43	113	2995.79.01	1449940.01
51	307791.45	1431305.48	114	298587.89	1452114.81
52	307541.47	1431154.09	115	2999.76.81	1453259.75
53	307161.83	1430255.65	116	300837.86	1458245.63
54	306783.25	1430364.29	117	301361.76	1462985.98
55	306021.44	1430764.19	118	304736.59	1464608.07
56	304869.78	1430272.04	119	307940.95	1465538.80
57	303728.73	1430079.44	120	309571.10	1467598.25
58	304057.78	1429670.74	121	310215.89	1470141.02
59	303983.46	1429217.75	122	310893.62	1471296.36
60	303670.92	1428667.41	123	312980.71	1472615.02
61	302785.49	1428295.62	124	313999.64	1474457.06
62	302181.15	1428335.25	125	314940.05	1475234.13
63	301946.73	1428713.87			

Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

This whole watershed is approximately about 43,534.24 hectares. Stretching towards Sablayan, Occidental Mindoro to Victoria and Naujan, Oriental Mindoro (Figure 3). The biggest portion is being part of Sablayan, Occidental Mindoro with 31,625.24 hectares (Table 1). However in terms of Barangays occupying the Mag-asawangTubig, Naujan has 22, Victoria 3 and Sablayan has 2 barangays.

Territorial jurisdiction of Mag-asawangTubigWatershedarea is jointly shared by CENRO Socorro, Oriental Mindoro and CENROSablayan, Occidental Mindoro.

Figure 3. Map showing the political boundary of Mag-asawangTubig Watershed area



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Table 1. Distribution of Area of Mag-asawangTubig Watershed

Location	Area(Hectares)	Percent
1. Sablayan, Occidental Mindoro	31,625.24	72.65
2. Naujan, Orintal Mindoro	7,912.37	18.18
3. Victoria, Oriental Mindoro	3,993.11	19.17
Total	43,534.24	100%

2.1.2 TOPOGRAPHY/GEO-MORPHOLOGICAL FEATURES

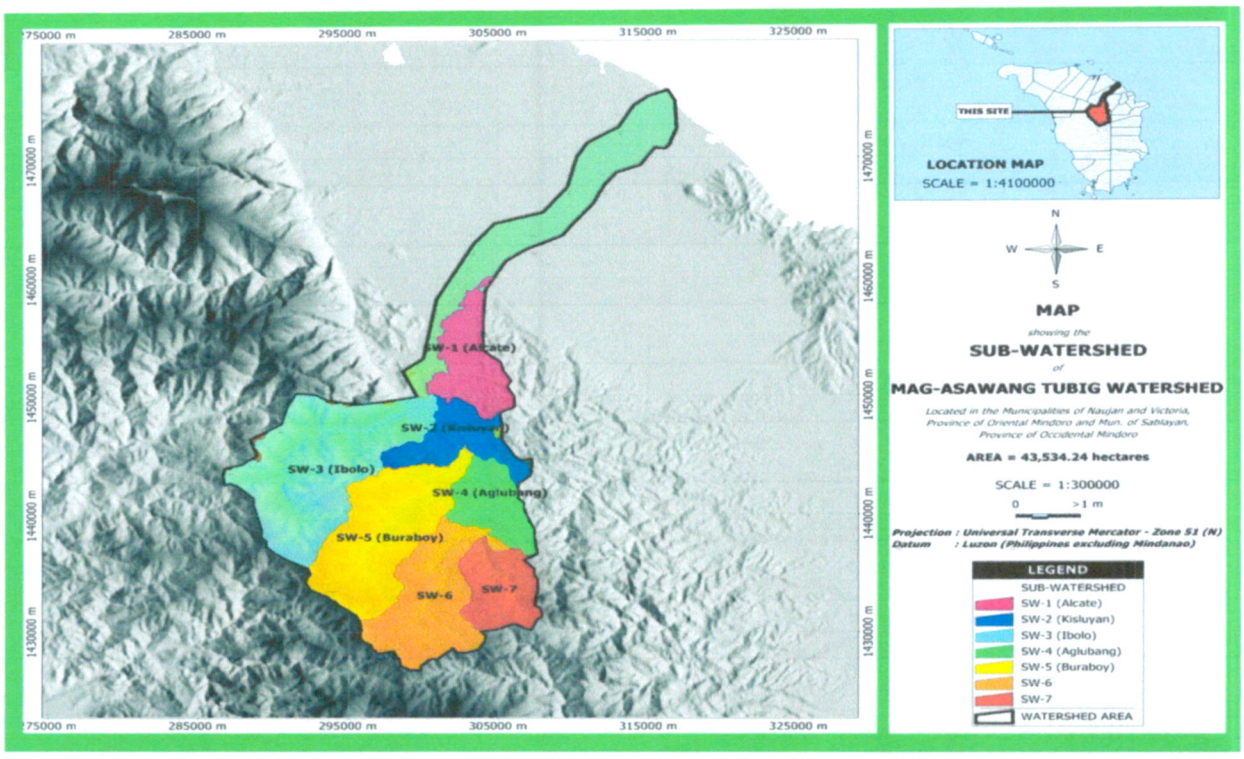
A. Watershed shape Parameters:

Shape parameters affect the hydrologic behavior of the watershed such as the run-off. A circular watershed has the tendency to have it's run-off reached simultaneously at the outlet. While elliptical shape watershed with the same drainage area as the circular watershed will spread out it's run-off behavior.

1. Area

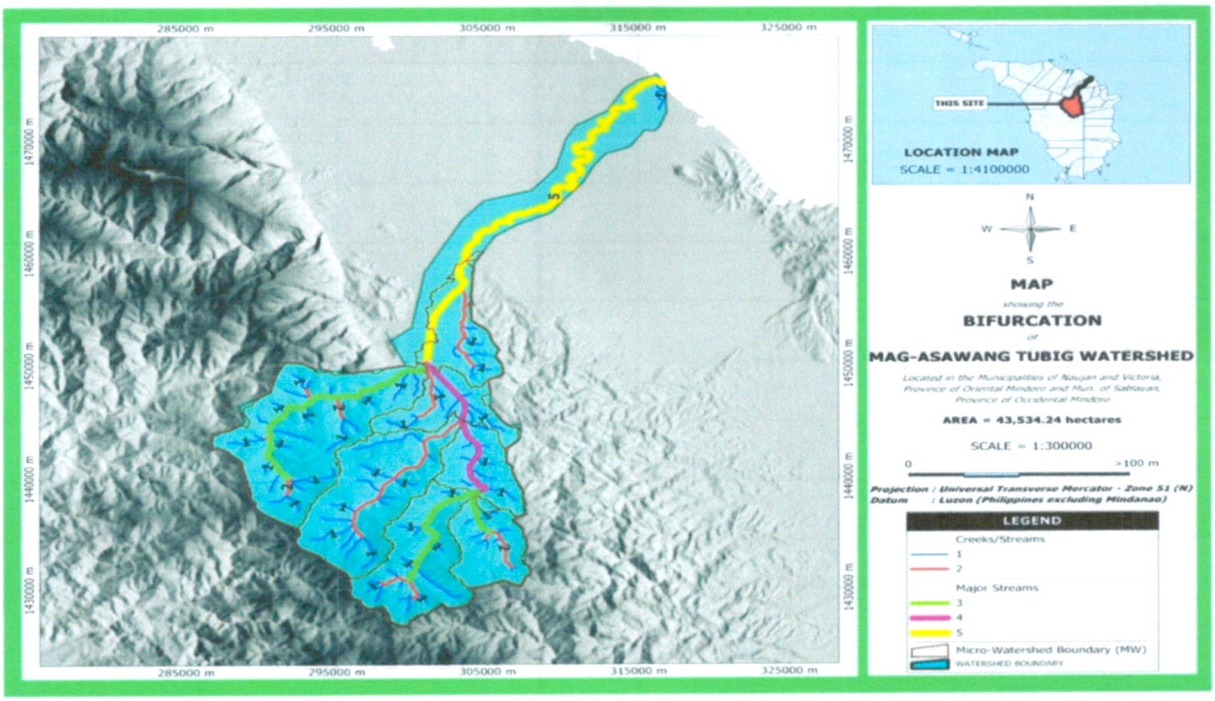
Located in the mountainous portion of Occidental and Oriental Mindoro Mag-asawangTubigwatershed area is subdivided into seven (7) Sub-watershed (Figure 3a). The biggest sub-watershed is SW No. 3 which has an area of 10,213.83 hectares while the smallest is SW No.5 (Table 4). These sub-watersheds are important for hydrological design because it reflects the volume of water generated from the rainfall. For run-off, it may be assumed that the volume of water available is the product of rainfall depth and drainage area.

Figure3a. Map showing the Sub-watershed area of Mag-asawang Tubig Watershed.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Figure 4. Bifurcation Map of MagasawangTubig Watershed Area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

2. **Gravelius form factor**

Form Factor is the ratio of the basin area to the square of the basin length (Horton, 1932). According to Pareta and Pareta(2011) the value of form factor should be less than 0.754. If the value is smaller, the watershed is said to be elongated. Form factor of Mag-AsawangTubig is 0.04 indicating that it is elongated shape and has a low peak flows for a longer duration. Computed form factor of each sub-watershed is in Table 4.

3. **Bifurcation ratio**

It is defined as the ratio of the number of stream of given order to the number of streams of the next highest order (Schuman, 1956). According to Pareta and Pareta (2011) normally bifurcation ratio range from 3 to 5. If the valuecomputed is low, the water discharges are higher with sharp peaks however if the result of the computation of ratio is higher, the discharge is low but with broader peaks. A watershed with lower value of bifurcation ratio is characterized with less structural disturbances (Strahler, 1964) while no distortion on the drainage pattern. For this watershed average bifurcation ratio is 3.65.Figure 4 shows the bifurcation map of the said watershed.

Table 2. No. of Streams and the computed value of Bifurcation of the watershed area.

Stream Order	No. Of Stream	Bifurcation ratio
1	79	6.58
2	12	4
3	3	3
4	1	1
5	1	

Average Bifurcation ratio is 3.65

4. **Elongation ratio**

Elongation ratio is the ratio of the diameter of a circle (Dc) having the same area as the basin to the maximum basin length (Lbm) (Schumn,1965).

Table 3.Index of Elongation Ratio.

Range of Elongation Ratio	Remarks
0.9-1.00	Circular
0.8-0.9	Oval
0.7-0.8	Less Elongated
0.5-0.7	Elongated
Less than 0.5	More elongated

Source: (Pareta and Pareta, 2011)

Table 3 shows when the ratio is said to be circular if the computed elongation ratio approaches the values of 1, this circular watershed has it's run-off from different parts of the basin reaching the outlet at the same time that will result to a more peak run-off and flood-peak as compared to elliptical or elongated watershed. Computed elongation ratio of MagasawangTubig is 0.25. Comparing this result to the index above, it falls within the category of more elongated shape.

5. **Circulatory ratio**

The ratio of the watershed to the area having the same perimeter as the watershed is called as the circulatory ratio. According to Miller (1953) basin of the circulatory ratio ranges from 0.4 to 0.5 that indicates strongly elongated and highly permeable homogenous geologic materials (Pareta and Pareta, 2011). Several factors influenced the circulatory ratio such as the length and

frequency of streams, geologic structure, land-use, land cover, climate and relief with slope of the basin (Parveen et. al. 2012) If the value computed is approaching 1, this indicated that the shape of the basin is circular, infiltration is uniform and the excess water will takes longer time to reach the basin outlet. Computed value of circulatory ratio of Mag-asawangtubig range from 0.24 to 0.58 does not corroborate Miller's study but less than the value of 1 which means that the shape of the basin is less circular.

6. **Basin length.**

According to Schumn (1956) this is the straight line from the mouth of the basin to the farthest point of the basin perimeter. Measured basin length of Mag-AsawangTubig Watershed is 70.42 kilometers (Table 4).

Table 4. Computed value of watershed parameters

SUBWATERSHED	WATERSHED SHAPE PARAMETERS				
	Area (HAS.)	Form Factor	Elongation	Circulatory	Basin Length
SW1(Alcate)	**3,288.21**	**0.25**	**0.56**	**0.3**	**11,572.00**
SW2(Kisluyan)	**2,859.11**	**0.33**	**0.65**	**0.24**	**9,302.69**
SW3(IBOLO)	**10,213.83**	**0.08**	**0.07**	**0.46**	**16,960.46**
SW4(BURABOY)	**7,700.21**	**0.03**	**0.62**	**0.48**	**1,600.73**
SW5(AGLUBANG)	**2,834.57**	**0.11**	**0.65**	**0.54**	**9,274.73**
SW6	**5,925.57**	**0.08**	**0.66**	**0.35**	**13,199.83**
SW7	**3,072.18**	**0.12**	**0.74**	**0.58**	**8,514.42**
TOTAL	**35,893.68**				**70,424.86**

B. **Watershed Relief Features**

1. Relief Ratio

Watershed relief has an important role in the drainage system development, surface and subsurface water flow, permeability, landform development and erosion property of the terrain. Relief ratio is the difference in elevation between the highest point of a watershed and the lowest point of the floor valley. Table 5

indicates the computed relief ratioof the watershed area. This shows that Sub-watershed 6 and 7 has the highest computed value in terms of relief ratio.

2. Relative Relief

This is the ratio between the highest elevation and the perimeter of the basin.

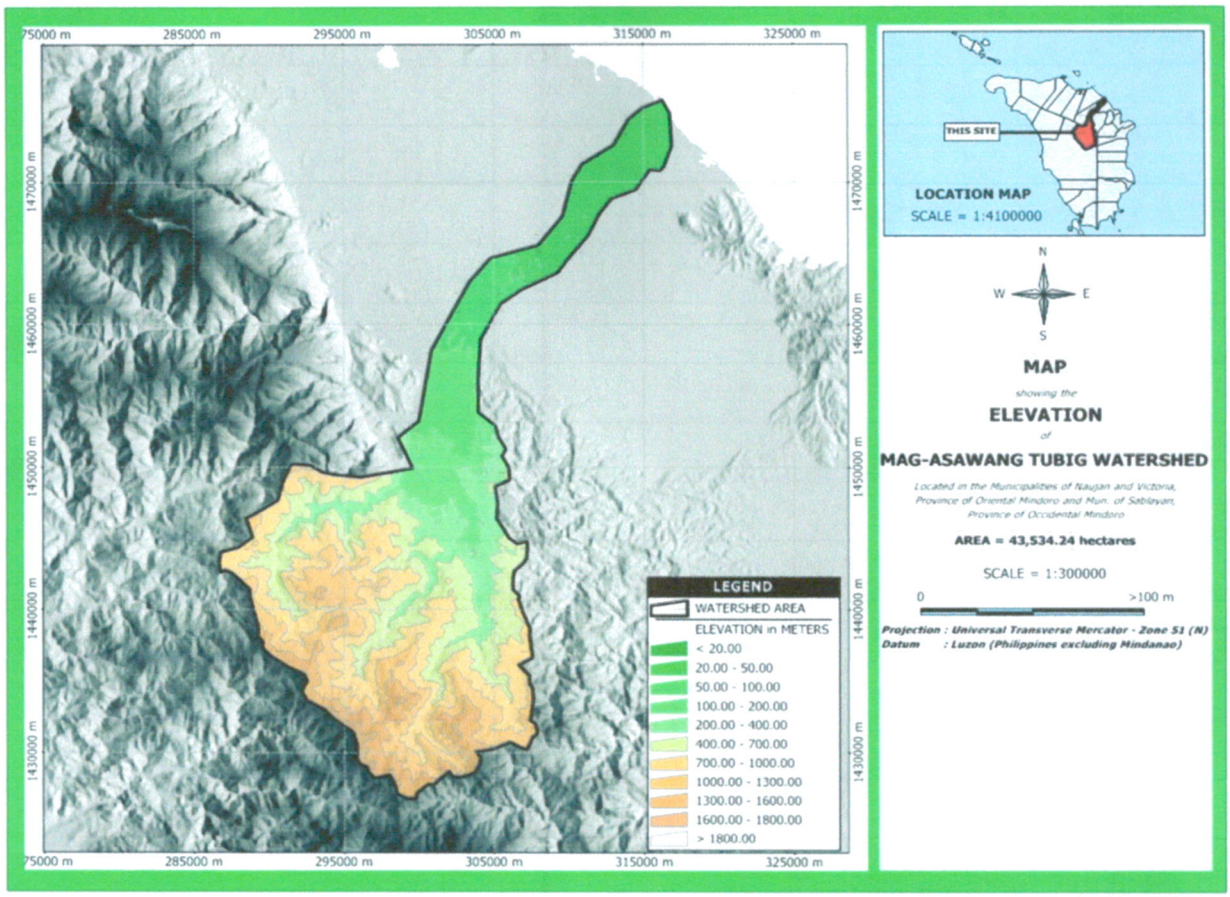
Table 5. Relief Ratio and Relative relief of the watershed area.

SUB-WATERSHED (MW)	Perimeter(km)	Relief Ratio	Relative Relief	Elevation		Basin Length(km)
				Maximum	Minimum	
SW 1 (Alcate)	36.87	0.04	468	498	30	11.57
SW 2 (Kisluyan)	38.36	0.05	906	1020	114	9.3
SW 3 (Ibolo)	53.11	0.09	1542	1656	114	16.96
SW 4 (Bukaboy)	45.72	0.1	1668	1842	174	16
SW 5 (Aglubang)	25.7	0.09	828	981	153	9.27
SW 6	46.41	0.12	1560	1862	302	13.19
SW 7	25.63	0.16	1333	1659	326	8.51
TOTAL	271.8					84.8

3.Elevation

The highest elevation found in the area is within Sub-watershed No. 6 while the lowest with 30 meters above sea level is found in Sub-watershed No. 1 (Alcate area) (Figure 5). Table 5 shows the distributionsof the elevation in seven sub-watersheds of Mag-asawangTubig. Elevation is key in species survival as well development of growth thus needed in determining what species are going to be used as planting material. In a higher elevation, the temperature is lower but higher in terms of precipitation.

Figure 5. Elevation Map of Mag-asawangTubig Watershed area

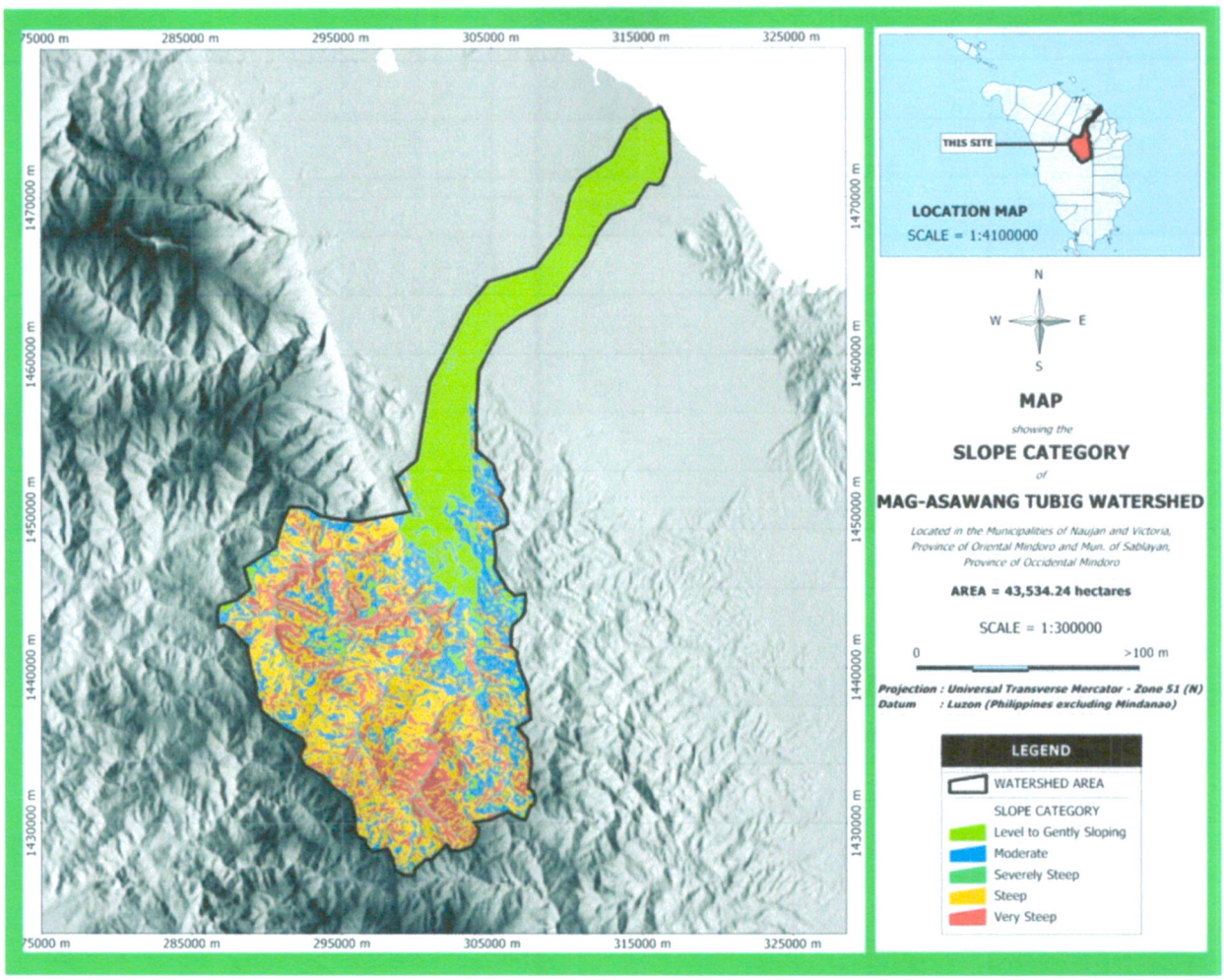


Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

4.Slope

Slope plays vital role in infiltration in watershed area as against the water run-off. Infiltration is inversely related to run-off, the gentler the slope the higher is the infiltration and as the slope become steeper the less is the opportunity for a good infiltration and the more tendency for run-off (Parveen et. al. 2012). Five categories were used in the area to know the distribution of it' slope, these are the following: 0-8 % (level to gentle slopes), (8-18%) gentle to moderate slopes, (18-30%) moderate to very steep slopes, (30-50%) very steep slopes and (above 50 %) severely steep. Figure 6 and Table 6 shows the distribution of slopes in the watershed area. Around 29,555.67 hectares had been classified in the area with below 30 percent slope.

Figure 6. Slope Map of Mag-asawangTubig Watershed Area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Table 6.Slope distribution in Mag-asawangTubig Watershed area.

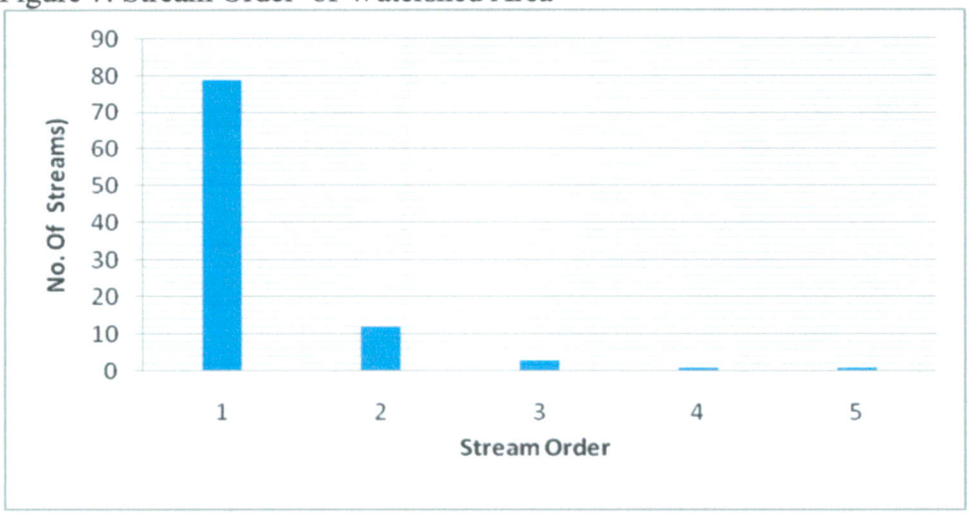
SUB-WATERSHED	0-8%	8-18%	18-30%	30-50%	above 50 %
MW-1(ALCATE)	2,219.31	765.56	232.39	18.08	None
MW-2(KISLUYAN)	1,311.50	1,026.48	372.64	95.75	None
MW-3(IBOLO)	1,049.30	2,810.23	4,419.09	1969.39	6.9
MW-4(BURABOY)	480.33	1,747.21	3,744.49	1715.3	10.07
MW-5(AGLUBANG)	480.58	1,329.95	824.27	195.1	None
MW-6	178.91	1,134.02	2,842.07	1760.23	15.15
MW-7	242.27	1,054.04	1,291.03	482.32	0.05
TOTAL	**5,962.20**	**9867.49**	**13725.98**	**6236.17**	**32.17**

C. **Channel Morphology**.

1. Stream Order

The first step in the drainage basin analysis is the designation of the steam order. Horton(1945) first advocate this but Strahler (1952) scheme modified this ordering scheme. Following the set by Strahler (1952), Mag-asawangTubig stream Ordering has been counted with five. It is noted that as the stream order increases the number of streams decreases (Figure 7).

Figure 7. Stream Order of Watershed Area



2. Stream Length

According to Strahler (1964) Horton's law of stream length support the theory that geometric similarity is preserved generally in watershed of increasing order. The length of the stream is from the drainage divide to the mouth of the river.Computed total stream length is 198.59 kilometers. Measured stream length of the watershed is shown in Table 7.

3. Mean Stream Length

Mean stream length is derived by dividing the total length of stream of an order by the segment in the order. Table 7 shows the computed mean stream length of this watershed is from 2.1 to 3.17. Sub-watershed no. 6 has the low mean stream length while sub-watershed no. 6 has the longest with 3.17.

Table 7. No. of Streams

Subwatershed	No. Of Stream	Length of Stream, (km)	Mean Stream Length
SW 1(Alcate)	7	16.38	2.34
SW2(Kisluyan)	8	20.64	2.58
SW3(Ibolo)	28	64.76	2.31
SW4(Buraboy)	14	44.42	3.17
SW5(Aglubang)	8	23. 84	2.98
SW6	17	35.69	2.1
SW7	12	16.69	1.39

D. DrainageTexture of the watershed

1. Drainage density

Drainage density is defined as the ratio between the total length of all the stream and area of watershed. This is the measurement of how the watershed is drained by stream channels. Factors that affect the drainage density are the climate and physical characteristics of the basin. Infiltration capacity of the soil and the rock type lies underneath affects the run-off in a drainage basin. Impermeable grounds put more surface water run-off that causes to have more streams in the watershed area. High drainage density in a river also has the indications of greater flood risks. Table 8 shows the index of the drainage density. Computed values of all drainage density of all sub-watershed within Mag-asawang Tubig are less than 5 kilometers. This is indicating that there is lesser flood risk in the area.

Table 8.Index of Drainage Density Value

Range(km/square km)	Description
Less than 5	Low
5-13.7	Medium
13.7-155.3	High
7155.3	Very High

Source:Vendiola, undated

2. **Stream density**.

Stream Density is the ratio of the number of streams and area of the watershed This is also termed as stream frequency. This is correlated to drainage density, as such as the stream population increases drainage density also increases.

Permeability, infiltration capacity and relief of the watershed are important factors that affects the drainage density.

3. Length of the Overland flow

According to Horton(1932) the length of the overland flow is approximately equals to half of the reciprocal of drainage density. It is the length of the river or ground surface before reaching the channels. This is an important variable in drainage basin development.Length of overland flow of the watershed is 0.89 kilometer. This means that there is a need for the surface water to travel 0.89 kilometer to get concentrated on the main channel.

Computed value of drainage density, frequency and the length of the overland flow is shown in Table 9.

Table 9. Drainage texture

SUB-WATERSHED	Drainage Density (Km/km^2)	Drainage Frequency (No/km^2)	Length of Overload Flow (Km)
SW 1(Alcate)	0.5	0.21	1
SW2(Kisluyan)	0.72	0.28	0.69
SW3(Ibolo)	0.63	0.27	0.79
SW4(Buraboy)	0.58	0.18	0.87
SW5(Aglubang)	0.84	0.28	0.59
SW6	0.6	0.29	0.83
SW7	0.54	0.39	0.92

Computed values of bifurcation and drainage density are both low for Mag-AsawangTubig watershed area indicating that there is less structural disturbances within the said watershed.

2.1.3. GEOLOGY

A. Mineral Deposits

Mag-asawangTubig lies within the area where mining exploration is very much active. Based on previous exploration by Mindex, the area is home to large deposits of Cobalt and Nickel, one of the largest in the Fareast.

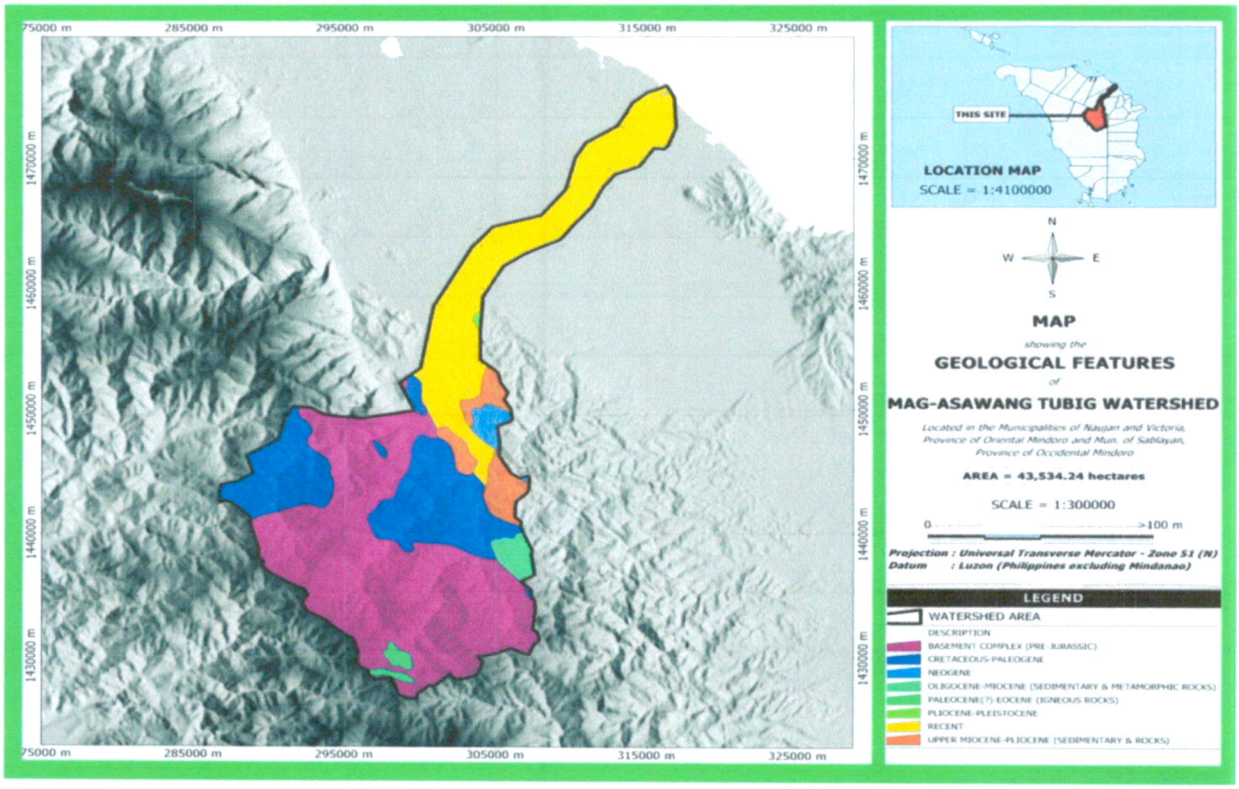
B. Geological Formation

There are eight soils and rock formation identified within Mag-asawangTubig watershed area. These are Pre- Jurassic, Cretaceous-Paleocene, Neo-gen, Oligocene-Miocene (sedimentary and metamorphic rocks) Pliocene-Pleistocene, Recent and Miocene type of soil and rock formation (Figure 8). Majority of the area evolve from Pre-Jurassic to Jurassic era then rest from recent formation and Cretaceous-Paleogene era (Table 10).

Table 10. Geologic Formation in the Watershed Area

Period of Formation	Area (hectares)
1. Pre-Jurassic	20,645.18
2. Cretaceous=Paleocene	9,166.87
3. Neogene	617.92
4. Oligocene-Miocene (Sedimentary Formation	714.91
5. Paleocene- Eocene (Igneous)	374.95
6. Pliocene-Pleistocene	54.16
7. Recent	9918.23
8. Upper Miocene-Pliocene (Sedimentary & Rocks)	

Figure 8.Geologic Map of Mag-asawangTubig showing different rock formation in the area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

C. Lithology

Rocks deposits found in the area are alluvial deposits ,Halconmetamorphosis and the ultramatic complex. Biggest part belongs to ultramatic complex which the nickel found embedded.

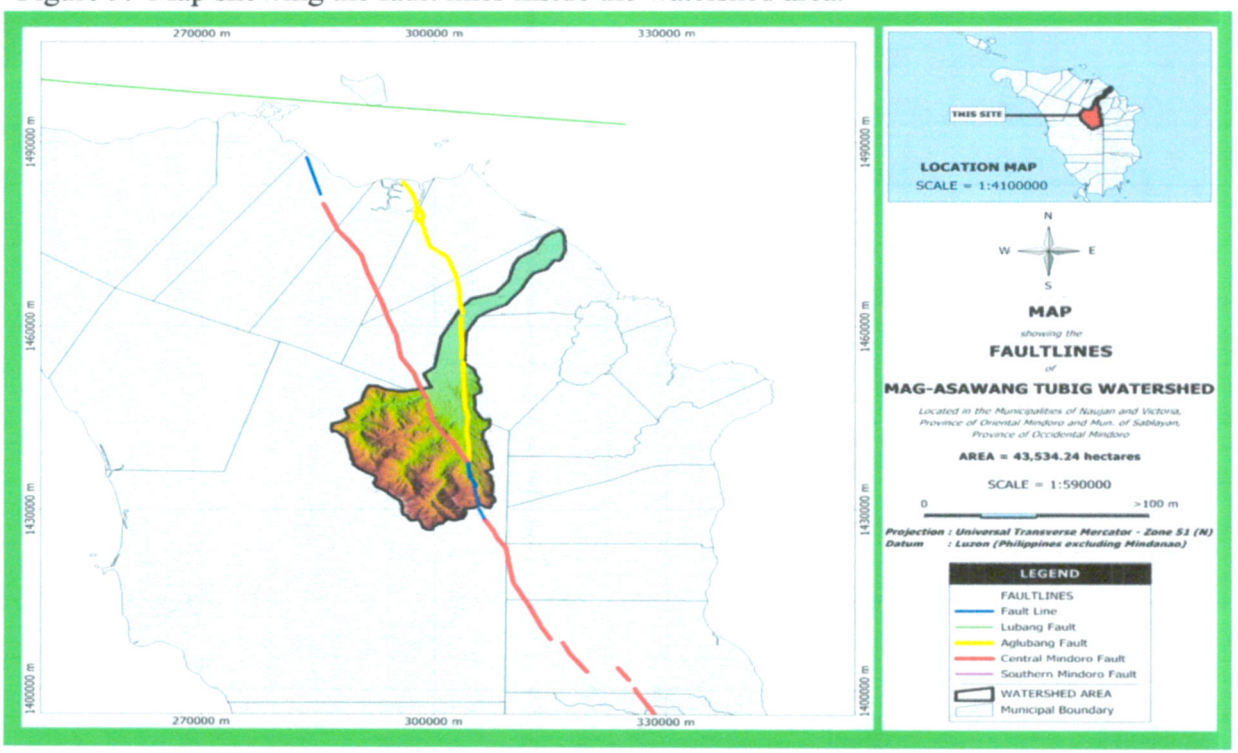
D. Composition

Four rocks deposits had been identified in Mag-asawangTubig watershed area, these are silt-sand-gravel, green schist with mia schist, associated with Halcon Metamorphic and dunnite and pendolite associated with ultramatic complex.

E. Seismicity

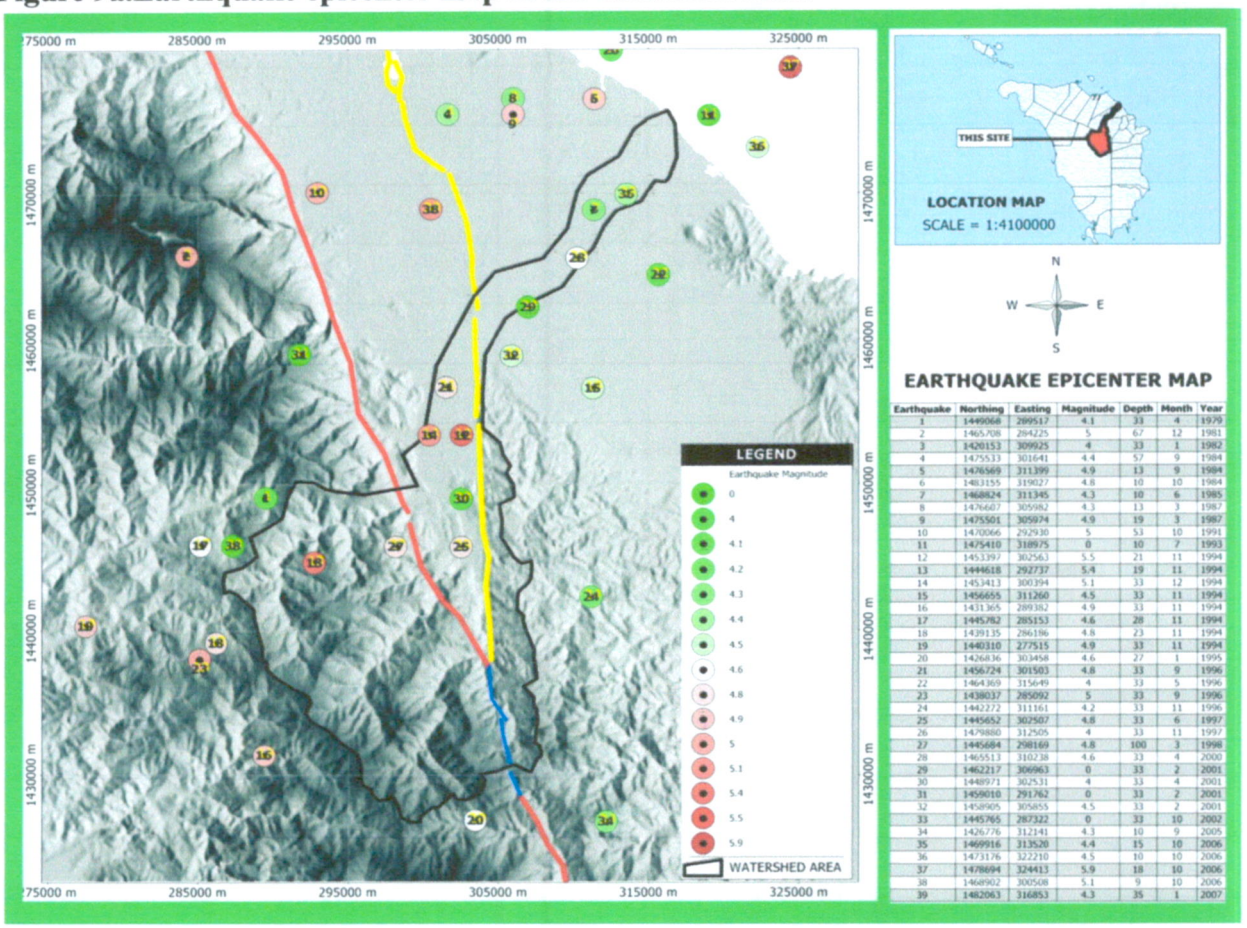
Figure 9 shows the four fault lines that pass through this watershed area. These are Lubang fault line, Aglubangfaultline, Central Mindoro faultline and Southern Mindoro Faultline. Recorded three earthquake in the area range from 5.4 and 5.9intensity (Figure 9a).

Figure 9. Map showing the fault lines inside the watershed area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Figure 9a.Earthquake epicenter map in the watershed area.



Earthquake	Northing	Easting	Magnitude	Depth	Month	Year
1	1449068	289517	4.1	33	4	1979
2	1465708	284225	5	67	12	1981
3	1420153	309925	4	33	1	1982
4	1475533	301641	4.4	57	9	1984
5	1476569	311399	4.9	13	9	1984
6	1483155	319027	4.8	10	10	1984
7	1468824	311345	4.3	10	6	1985
8	1476607	305982	4.1	13	3	1987
9	1475501	305974	4.9	19	3	1987
10	1470066	292930	5	53	10	1991
11	1475410	318975	0	10	7	1993
12	1453397	302563	5.5	21	11	1994
13	1444618	292737	5.4	19	11	1994
14	1453413	300394	5.1	33	12	1994
15	1456655	311260	4.5	33	11	1994
16	1431365	289382	4.9	33	11	1994
17	1445782	285153	4.6	28	11	1994
18	1439135	296186	4.8	23	11	1994
19	1440310	277515	4.9	33	11	1994
20	1426836	303458	4.6	27	1	1995
21	1456724	301503	4.8	33	9	1996
22	1464369	315649	4	33	5	1996
23	1438037	285092	5	33	9	1996
24	1442272	311161	4.2	33	11	1996
25	1445652	302507	4.8	33	6	1997
26	1479880	312505	4	33	11	1997
27	1445684	298169	4.8	100	3	1998
28	1465513	310238	4.6	33	4	2000
29	1462217	306963	0	33	2	2001
30	1448971	302531	4	33	4	2001
31	1459010	291762	0	33	2	2001
32	1458905	305855	4.5	33	2	2001
33	1445765	287322	0	33	10	2002
34	1426776	312141	4.3	10	9	2005
35	1469916	313520	4.4	15	10	2006
36	1473176	322210	4.5	10	10	2006
37	1478694	324413	5.9	18	10	2006
38	1468902	300508	5.1	9	10	2006
39	1482063	316853	4.3	35	1	2007

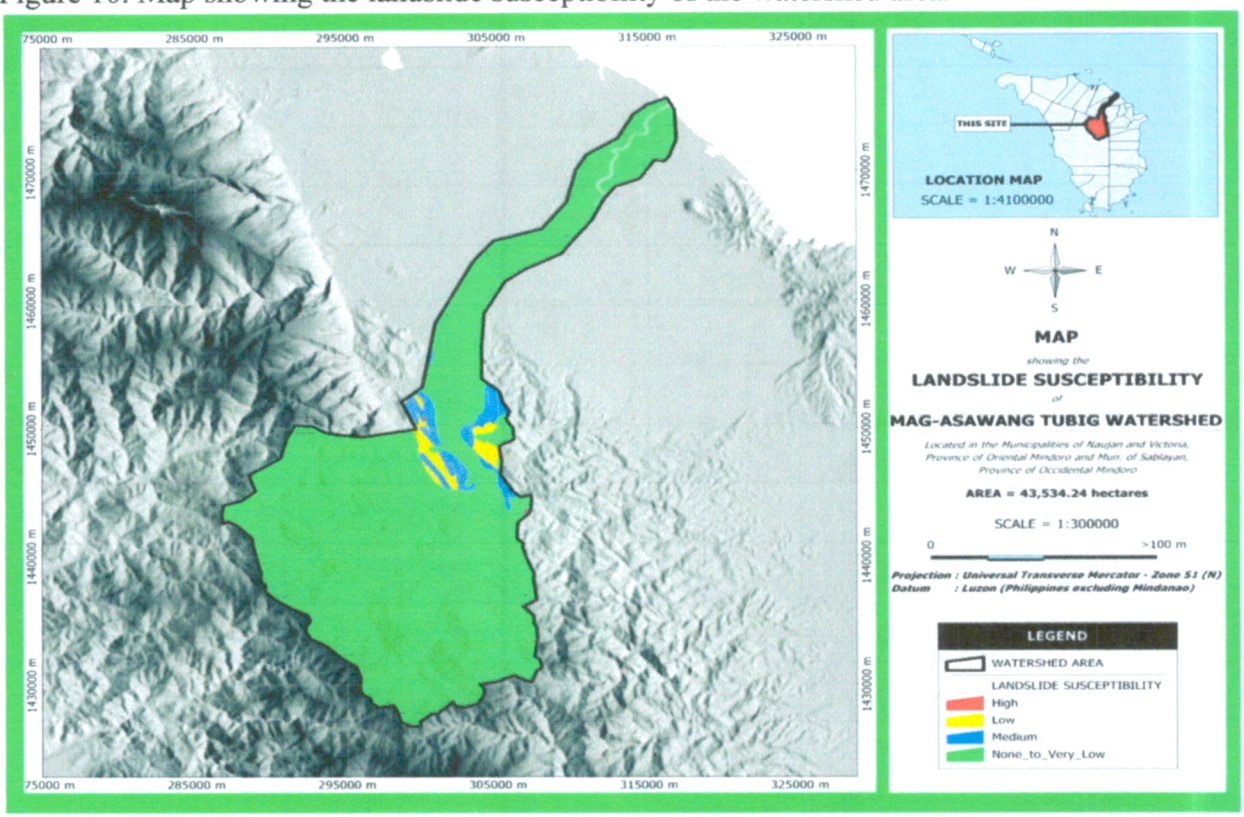
Source: **NAMRIA, Digital Elevation Model (DEM) ASTER data**

F. Geological Hazard

Vulnerability of the communities due to geological hazards had been identified in the area. These potential hazards are landslides (Figure 10 a), flooding and soil erosion.

Figure10 and Table 11 shows how the watershed is vulnerable to landslides while Figure 11 shows the risk of the communities to flooding along the river channel going to Estrella bay.

Figure 10. Map showing the landslide susceptibility of the watershed area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

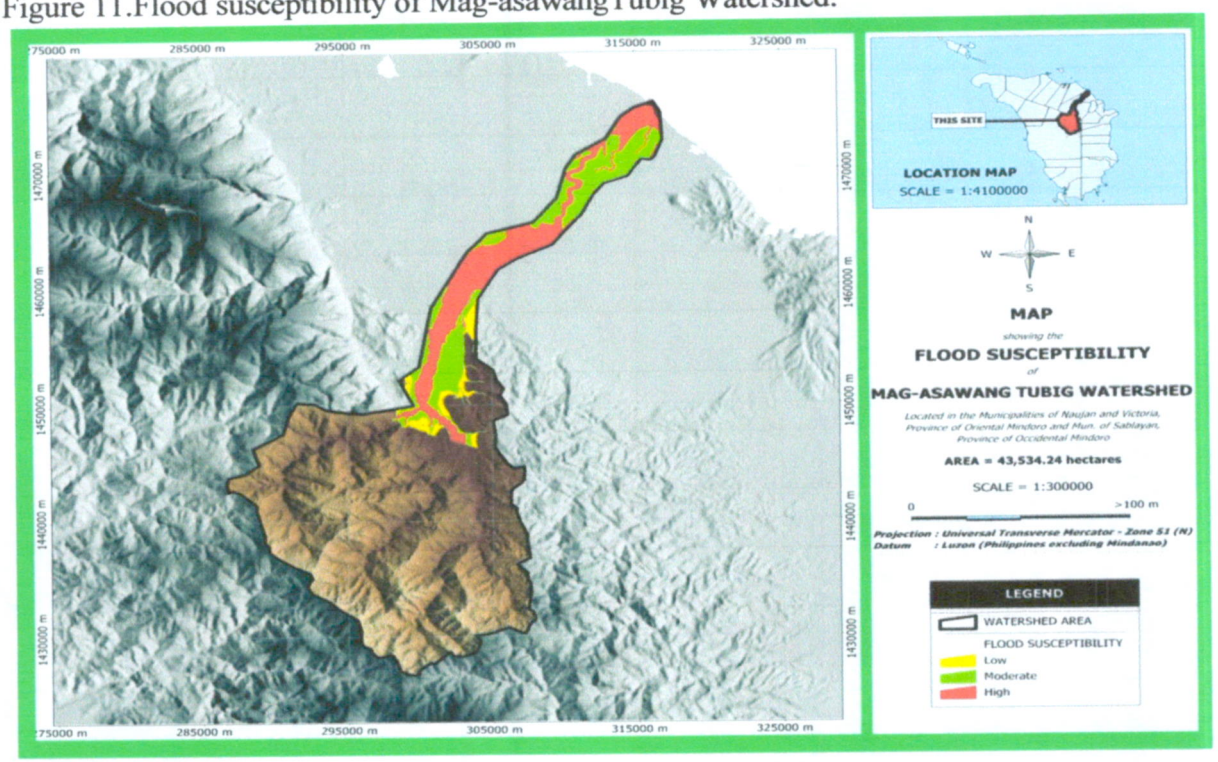
Table 11.Distribution of landslide susceptibility of the watershed area.

SUB-WATERSHED (MW)	None to very Low	Low	Moderate	High
SW 1 (Alcate)	2,587.77	198.86	527.88	0.01
SW 2 (Kisluyan)	1,849.15	356.13	643.33	7.78
SW 3 (Ibolo)	9,932.83	none	128.97	none
SW 4 (Buraboy)	2,815.91	0.11	14.2	none
SW 5 (Aglubang)	7,662.77	none	35.03	none
SW 6	5,928.67	none	none	none
SW 7	3,069.79	none	none	none
Total	33,846.89	555.1	1349.41	7.79

Figure 10 a. Landslide caused by 1994 earthquake within the watershed area.

Source: Vendiola undated

Figure 11.Flood susceptibility of Mag-asawangTubig Watershed.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

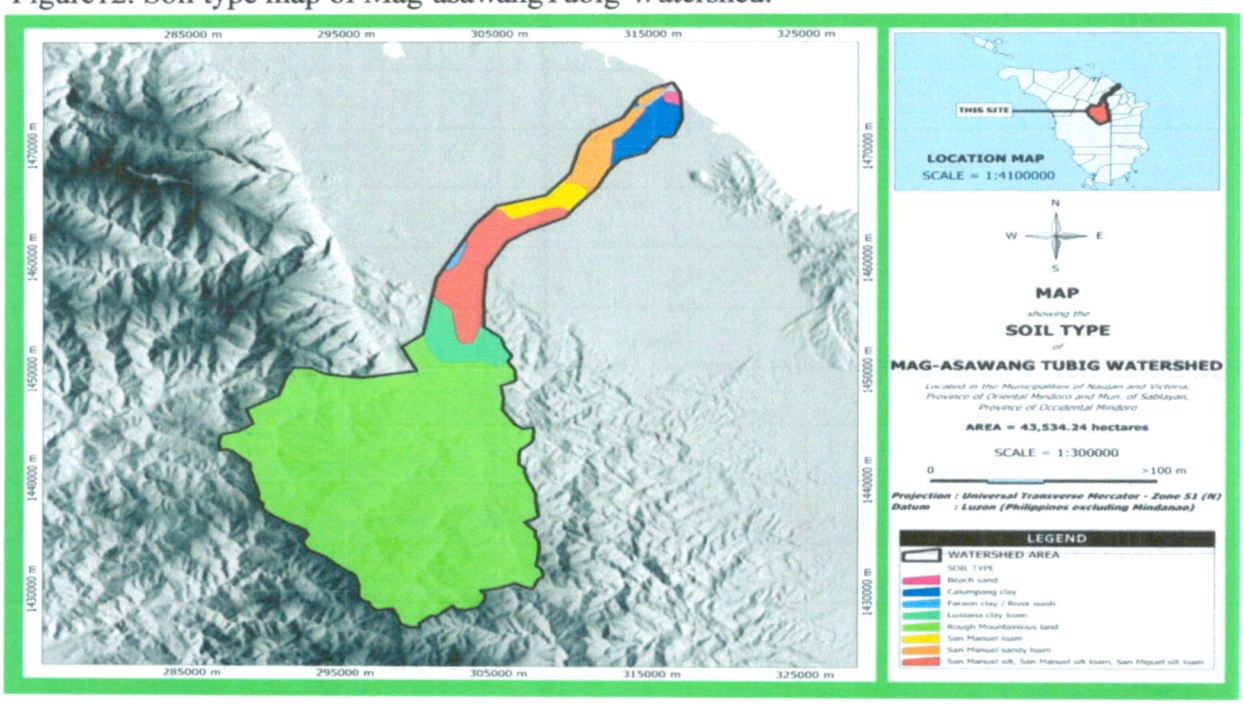
2.1.4 SOIL

Soils, as a product of natural hydrologic and geomorphic process is a layered mass of minerals and generally organic matter and rock fragments that differ from the parent material (rocks) from which it is derived in terms of morphology, physical and chemical characteristics, organism and organic content. Figure 12 and Table12 shows the eight soils type identified in Mag-asawangTubigwatershed area. Rough mountainous land dominated the soil type in the catchment basin having an area of 34,325.25 hectares. The entire catchment is classified by Bureau of Soil and Water Management as all belongs to mountain soil. Table 13 shows the physical and chemical characteristics of the soil of this watershed area while Figure 13 indicates the soil taxonomy/grouping of the watershed area.

Table 12.Soil type in the watershed area.

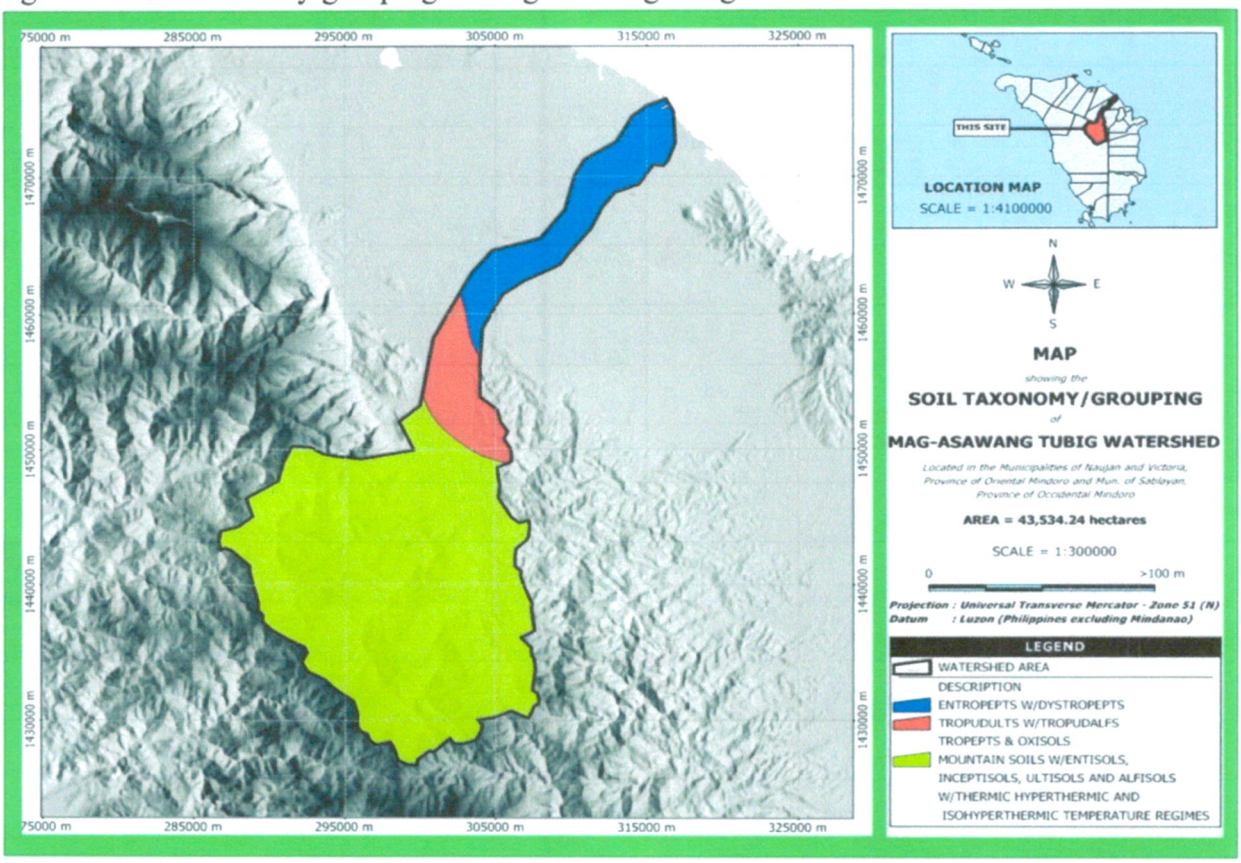
SOIL TYPE	AREA (Hectares)
1. Beach sand	130.73
2. Calumpang Clay	1,348.26
3. Faraon Clay/River wash	146.48
4. Louisiana Clay Loam	1,717.88
5. Rough Mountainous Land	34,325.25
6. San Manuel Clay Loam	921.48
7. San Manuel Sandy Loam	1,600.98
8. San Manuel Silt and Silt Loam	3,222.4

Figure12. Soil type map of Mag-asawangTubig Watershed.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Figure 13.Soil taxonomy/grouping of Mag-asawangTubig watershed area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Table 13. Soil Characteristics from sample site in SW2(Kisloyan)

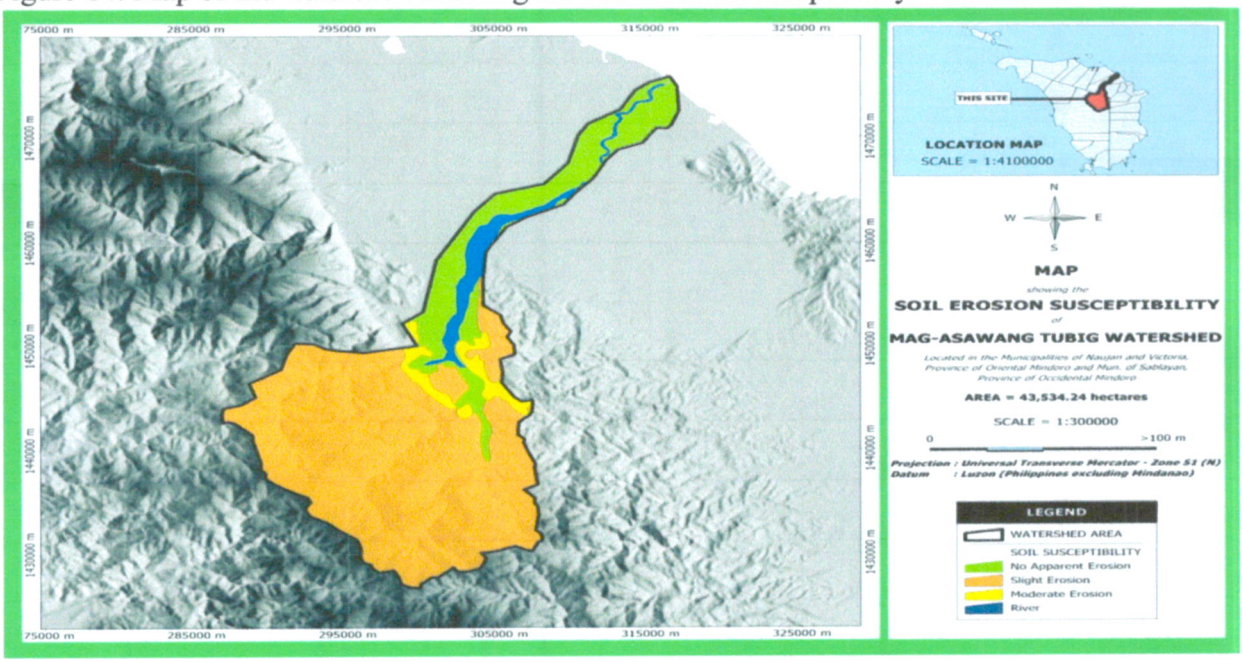
Soil Characteristics	Lower Elevation		Middle Elevation		Higher Elevation	
	Top Soil	Sub-Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil
OM (%)	3.46	1.53	3.57	2.45	6.07	2.68
Total N (%)	0.04	0.02	0.04	0.02	0.05	0.03
P(ppm)	0.8	Nil	0.5	0.3	0.04	0.3
K(ppm)	0.2	0.1	0.2	0.1	0.2	0.1
pH	5.9	6.4	5.5	6.2	5.3	6.2
Texture	Clay Loam	Clay	Clay Loam	Loamy Clay	Clay Loam	Loamy Clay
Soil Depth (m)	0.15	0.35	0.1	0.25	0.1	0.25
Bulk Density(g/cc)	1.15	1.25	1.08	1.12	1.02	1.08

Source: Vendiola, undated

1.Erosion Condition

Figure 14shows the erosion condition ofMag-asawangTubig Watershed area. Three categories were used to identify its vulnerability to erosion, these are no apparent erosion,slight erosion and moderate erosion. Around 30,826.29 hectares or 88.36 percent of the area had been identified to have slight erosive condition in the area (Table14).

Figure 14. Map of the watershed showing the soil erosion susceptibility of the area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Table 14.Soil erosion prevailing in the area.

SUB-WATERSHED (MW)	No Apparent Erosion	Slight Erosion	Moderate Erosion
SW 1 (Alcate)	1205.52	954.70	229.29
SW 2 (Kisluyan)	449.91	1386.70	896.29
SW 3 (Ibolo)	283.19	9568.53	387.24
SW 4 (Buraboy)	356.68	2417.69	55.74
SW 5 (Aglubang)	111.13	7500.21	86.57
SW 6	none	5928.67	None
SW 7	none	3069.79	None
TOTAL	2,406.43	30,826.29	1,655.13

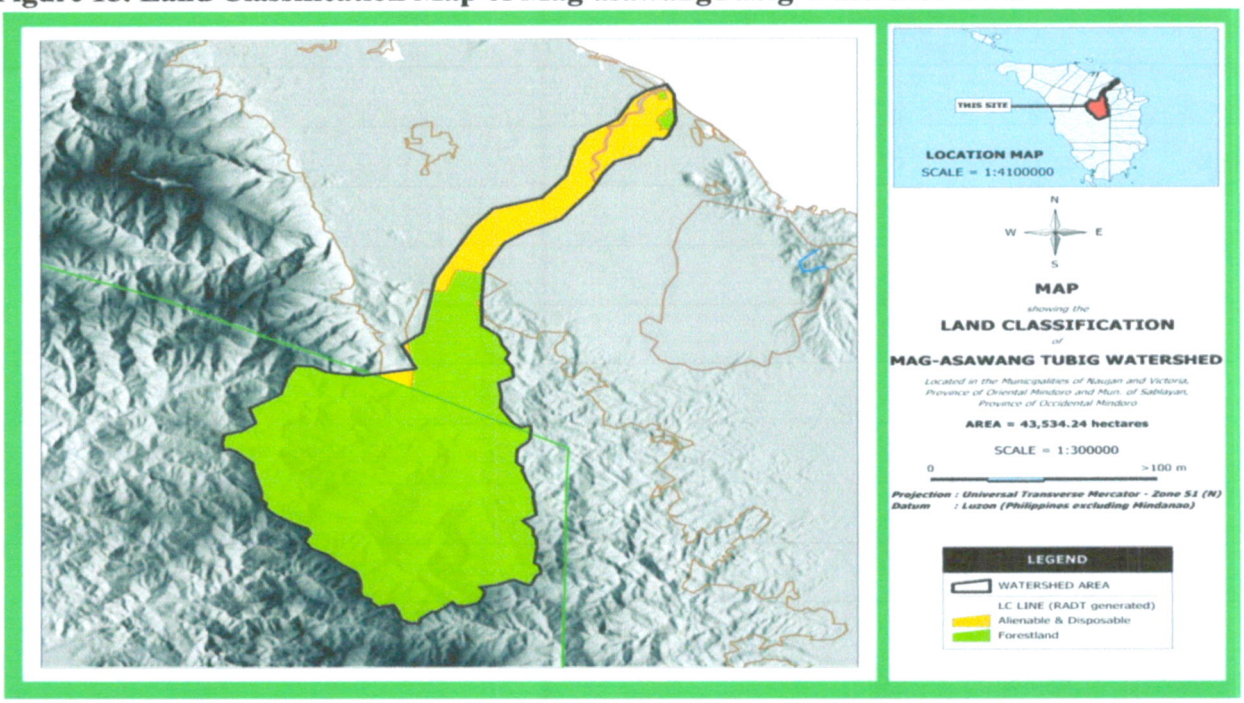
2.1.5 LAND CLASSIFICATION/LEGAL STATUS OFLAND

The whole Mag-asawangTubig watershed had been classified as forest land and agricultural land. Four tenurial instrument existed in the area. The biggest belongs to the Certificate of Ancestral Domain Claim (CADC), these are shown in Table 15, to wit:

Table 15.Tenurial Instrument inside the watershed area.

Tenurial Instrument	Area (Hectares)
1. Protected Area	2,168.46
2. CADC	10,816.54
3. FLGLA	180.86
4. Brgy. Forest	50.82

Figure 15. Land Classification Map of Mag-asawangTubig Watershed area.

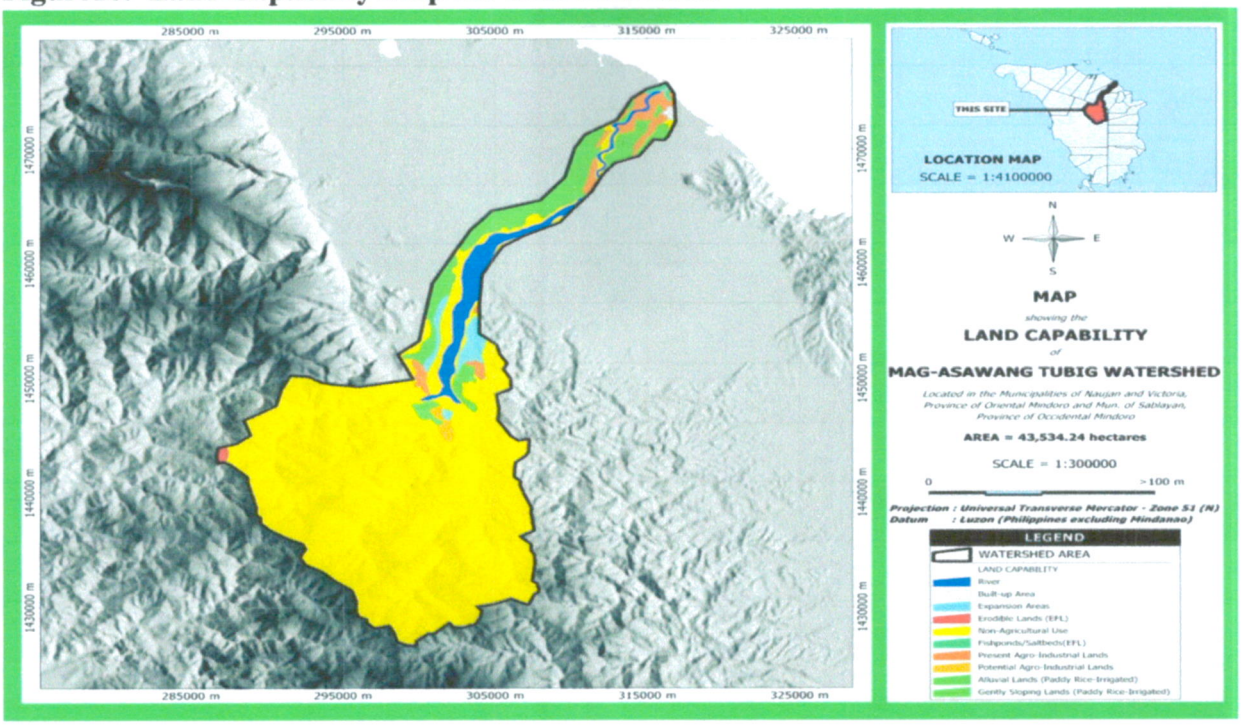


Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

2.1.6 LAND CAPABILITY

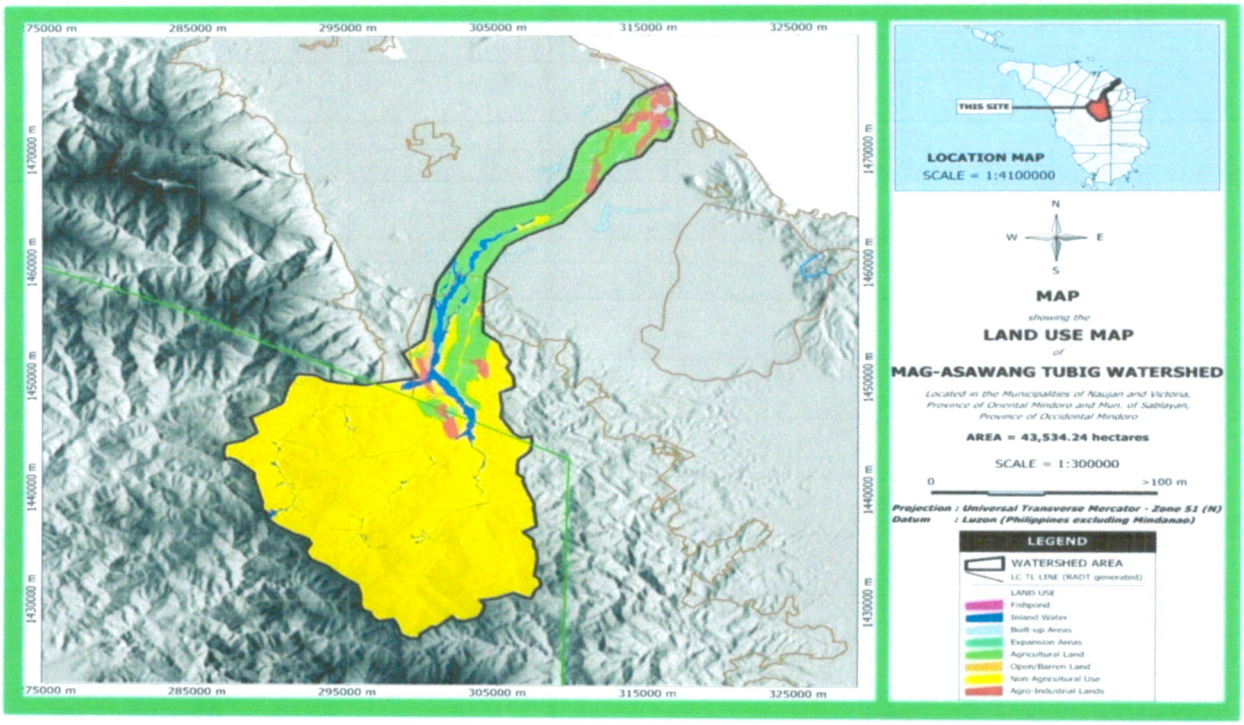
In general, most of the area of Mag-asawangTubig watershed is not suitable for agricultural purposes as shown in the map (Figure 16). This portion is best devoted for forest trees.

Figure16. Land Capability Map the watershed area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Figure 17. Land use map Mag-asawangtubig Watershed area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

2.1.7. LAND USE

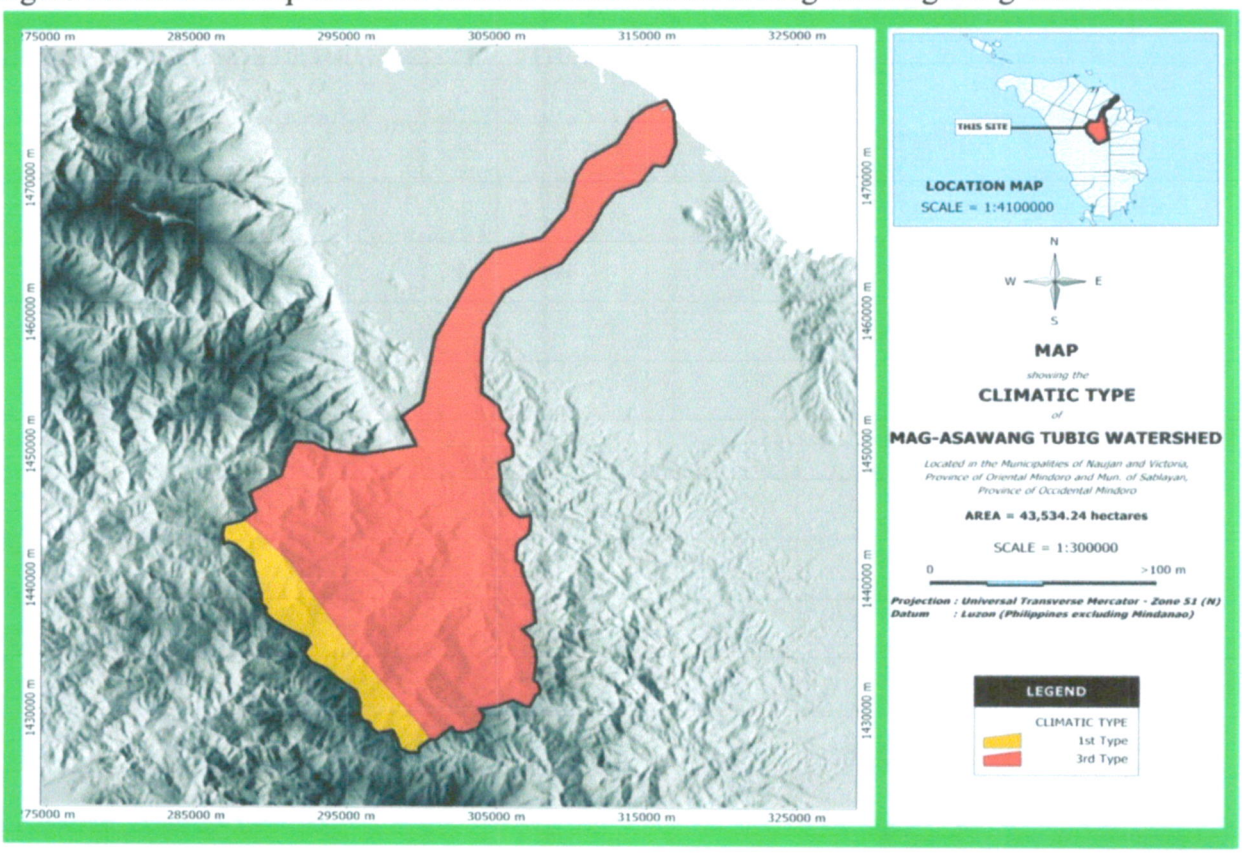
Figure 17 and Table 16 shows the type of land use found existing in the watershed area. These are forest land with a total of 31,533.55 hectares followed by land devoted for agricultural purposes covering an area of 6,473.38 hectares, inland water and fishpond to name a few.

2.1.8 CLIMATE

a. Rainfall

Mag-asawangTubig watershed area falls under Climatic Type I and IIIof the (Figure 18). Portion of the area under the Province of Occidental Mindoro falls under Climatic type I while area that belongs to Oriental Mindoro side falls under Climatic Type III. Under the Corona Classification Type III, there are no pronounced maximum rain period and a very short duration for dry period which last for one to three months while for climatic type I dry from November to April and wet for the rest of the year.

Figure 18.Climatic Map under the Corona Classification of Mag-asawangTubig Watershed.

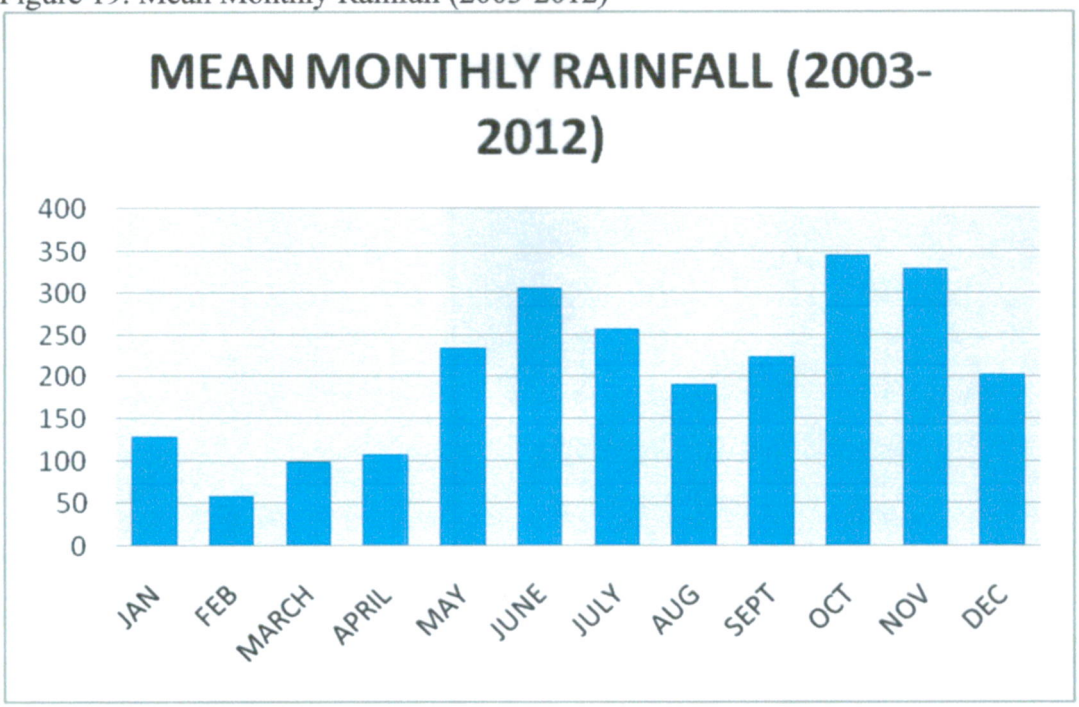


Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

Records obtained from DOST-PAGASA shows the average annual rainfall in the watershed from 2013 -2012 is 2476 mm (Figure 20). Mean monthly rainfall showed

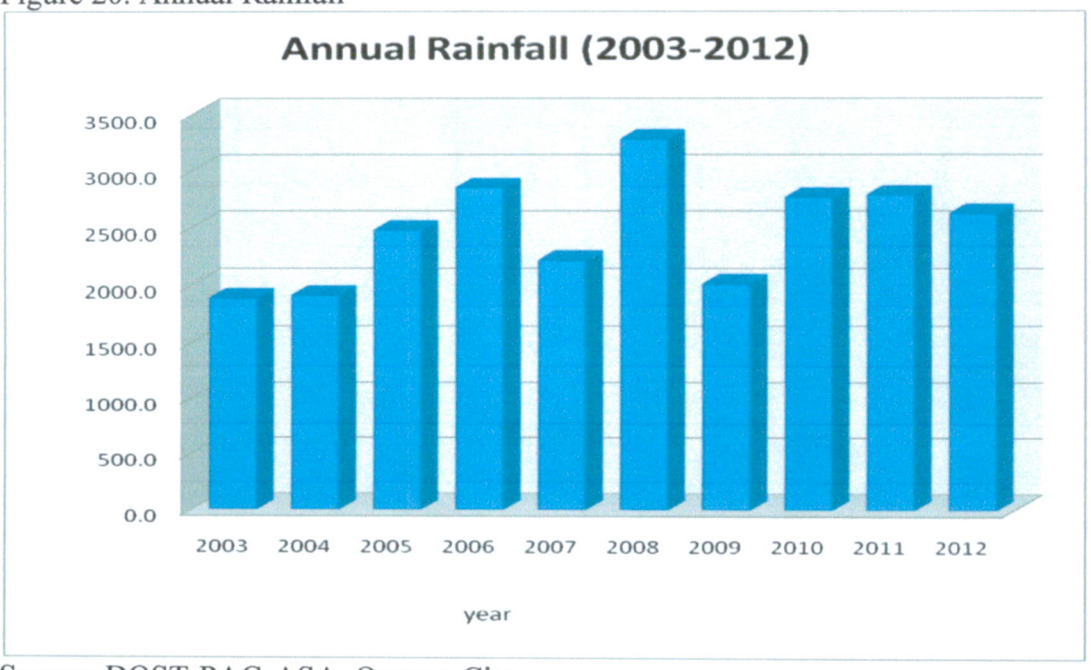
that the highest rainfall occurred in the month of June, November and December (Figure 19).

Figure 19. Mean Monthly Rainfall (2003-2012)



Source: DOST-PAGASA, Quezon City

Figure 20. Annual Rainfall

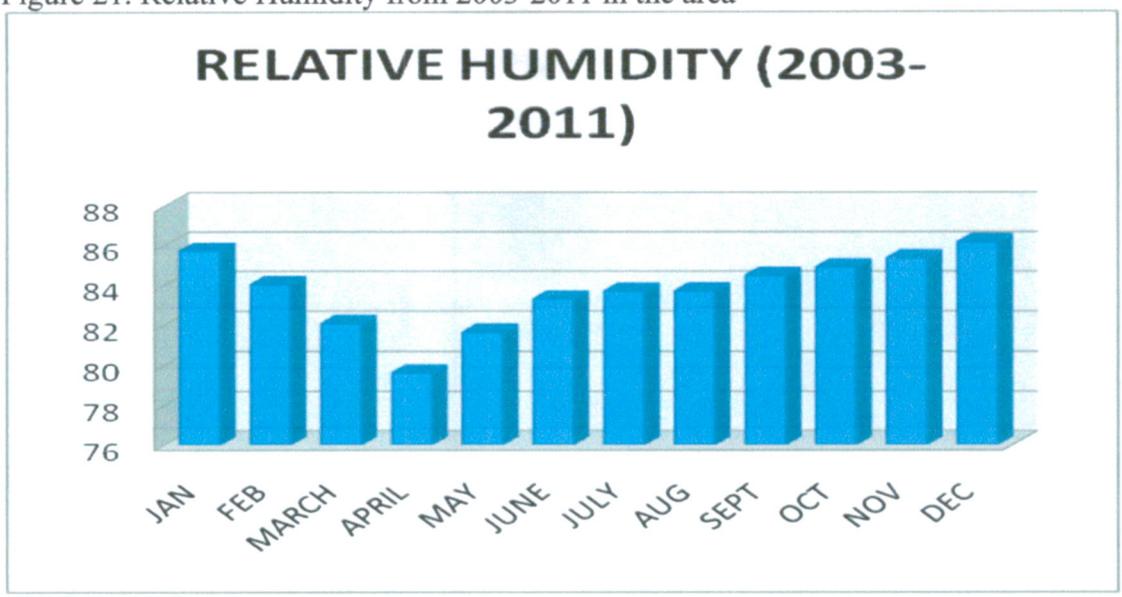


Source: DOST-PAG-ASA, Quezon City

b. Relative Humidity

In Mag-asawangTubigwatershedarea month of October has the highest relative humidity of 86.16 percent while the month of April has the lowest with 79.6 percent of relative humidity (Figure 21).

Figure 21. Relative Humidity from 2003-2011 in the area

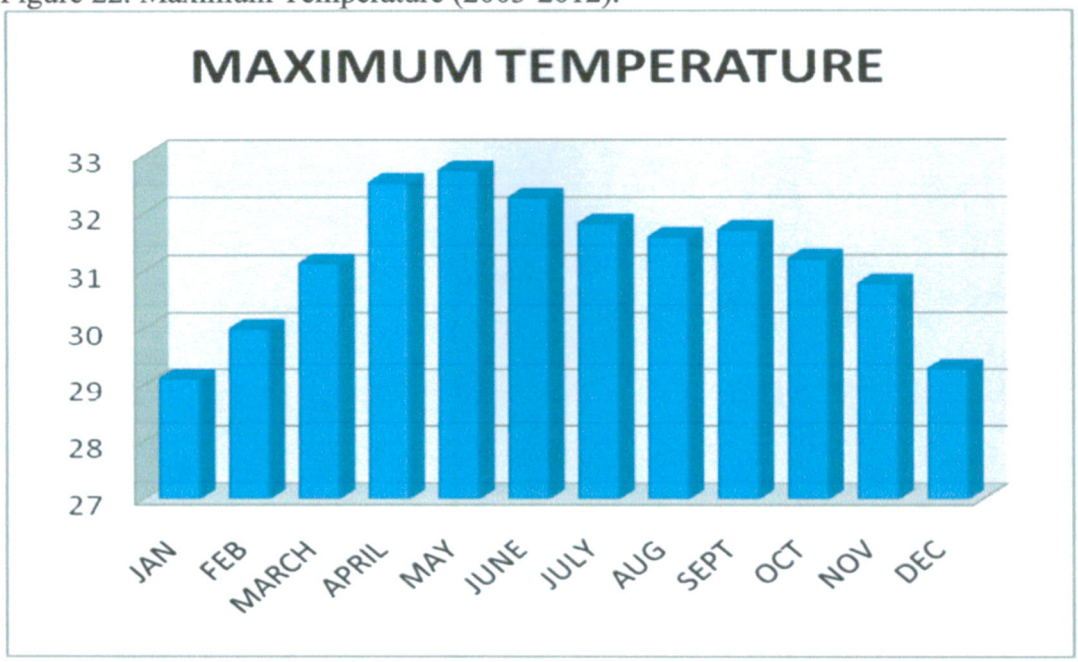


Source: DOST-PAGASA, Quezon City

c. Temperature

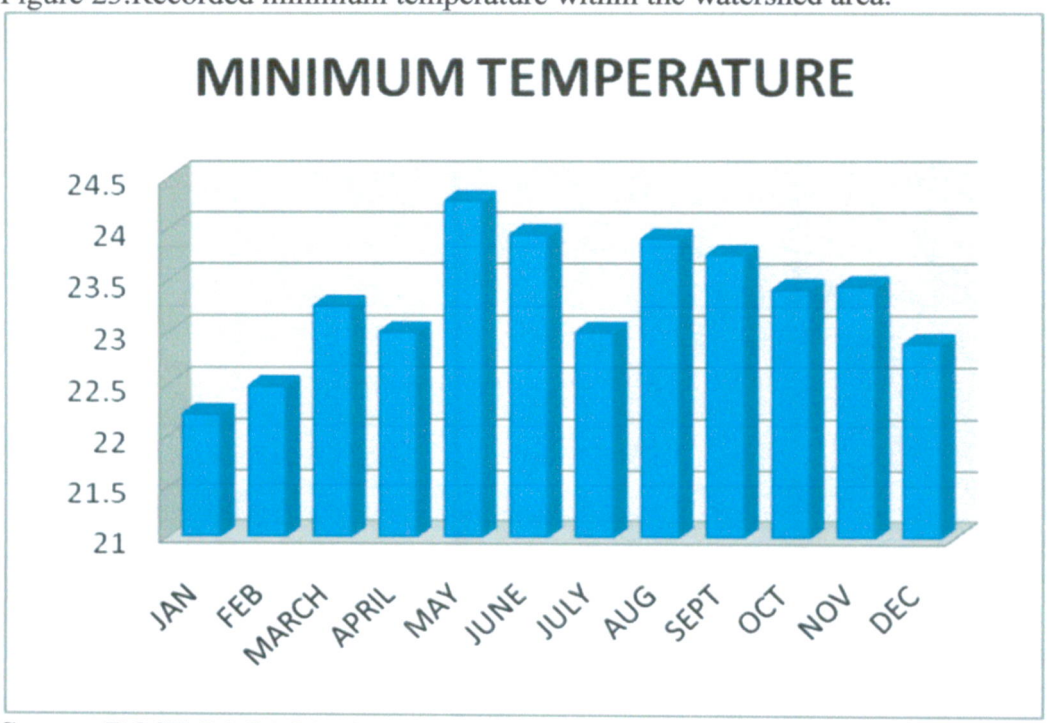
Coldest month in the area is the month of January and February with recorded temperature of 22.21 and 22.48degree Celsius(Figure 22) while April and May has the highest recorded temperature having a temperature of 32.52 and 32.73 degree Celsius respectively (Figure 23).

Figure 22. Maximum Temperature (2003-2012).



Source:DOST-PAGASA, Quezon City

Figure 23.Recorded minimum temperature within the watershed area.



Source: DOST-PAGASA, Quezon City

d. Wind Direction

Four times wind directions shifted in a year in the area, first is the Northeast monsoon occurred during the month of August up to December then continued up to March. Second shift is during the month of April where the wind move to east to northeast. By the month of May and June wind blows from the southeast then by October move to east.

e. Typhoon Frequency

Figure 24 shows how the province of Oriental Mindoro is open visited by typhoon for the past few years. Typhoon frequently occurred in this province from October to December of every year. June is also the month where typhoon is also frequent.

Figure 24.Typhoon Frequency in Oriental Mindoro.

Source: DOST-PAGASA, Quezon City

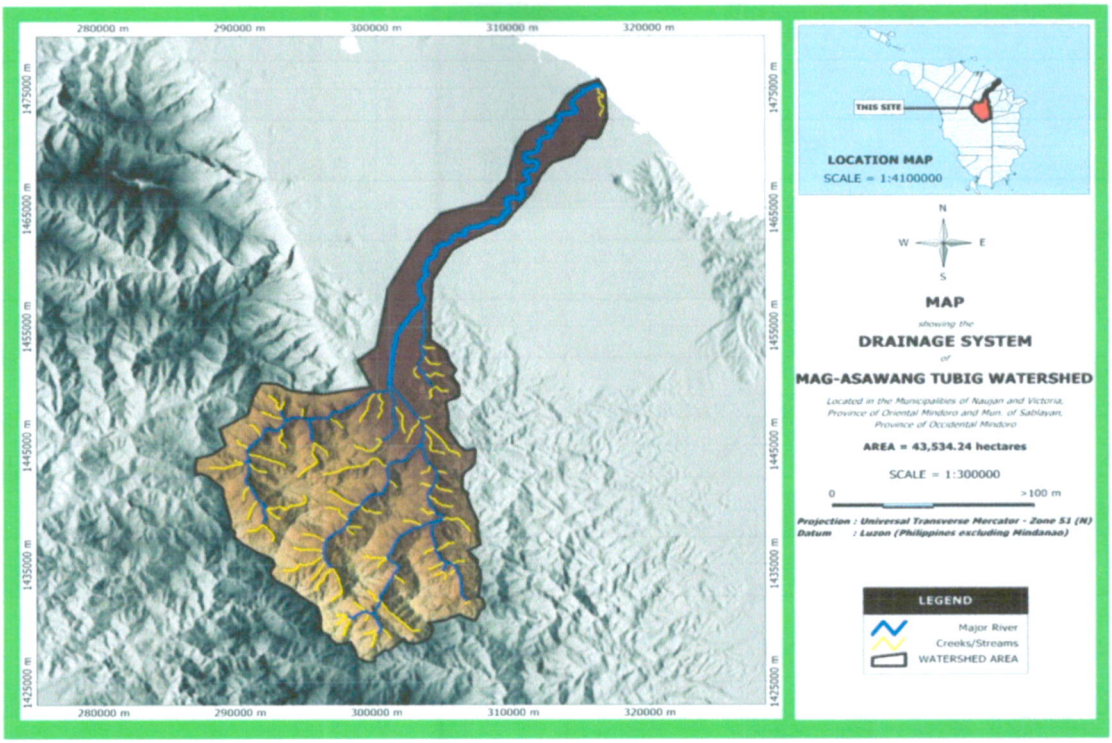
2.1.9 HYDROLOGY

Mag-asawangTubig had been subdivided into seven (7) sub-watershed areas. The total length of these streams is 198 kilometers (Table 4). This watershed area has the longest basin length of all the rivers in Naujan having a total 95 kilometers distance that traverses from San Andres flowing downward to Estrella bay. Mag-asawangTubig is classified by DENR as Class C Category which means that it is both conducive for recreational, industrial and aquatic uses. Laboratory analysis of water from Mag-asawang

Tubig River Channel is shown in Annex 20 . Figure 25 shows the drainage pattern of the watershed area.

This watershed is a mountainous area as such, has a very difficult groundwater sources but the sub-watersheds in the area had several streams and creeks that are possible sources of water respectively in the lowland areas.

Figure25. Map showing the drainage Pattern ofthe watershed area

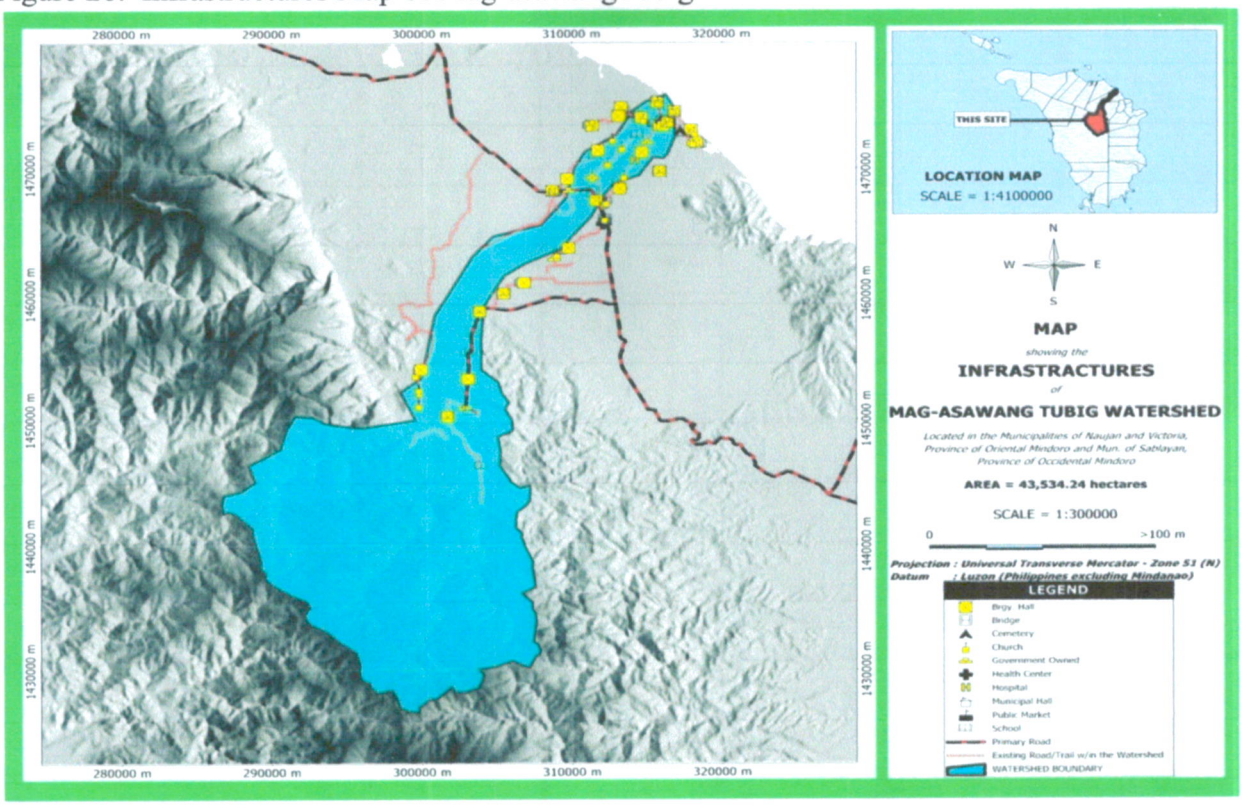


Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

2.1.11 INFRASTRUCTURE

Figure 26 shows the location of existing infrastructure found in the area, these are barangay halls, bridges, cemeteries, churches, health centers, hospitals, schools and public market.

Figure 26. Infrastructures Map of Mag-asawangTubig Watershed area.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

2.2 BIOLOGICAL RESOURCES

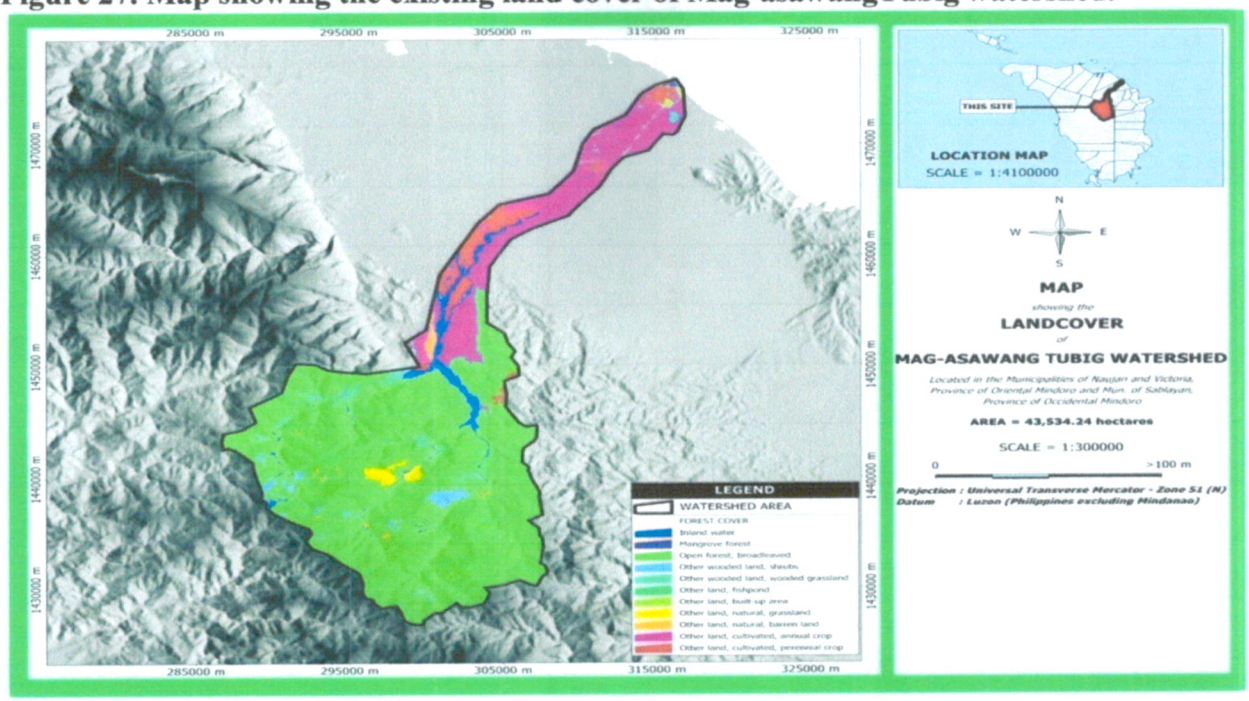
2.2.1 VEGETATION

Figure 27 and table 16 shows the eight (8) type of land cover found existing and identified in the watershed area.The biggest is occupied by forest land with a total of 31,533.55 hectares followed by land devoted for agricultural purposes covering an area of 6,473.38 hectares.

Table 16. Land cover of Mag-asawangTubig Watershed

LAND COVER	AREA (Hectares)
1. Mangrove	15.97
2. Inland water	2014.83
3. Forest	31,533.55
4. Built-up Area	242.10
5. Agricultural Land	6,473.38
6. Fishpond	57.15
7. Grassland	674.75
8. Brushland	1495.28

Figure 27. Map showing the existing land cover of Mag-asawangTubig watershed.



Source: NAMRIA, Digital Elevation Model (DEM) ASTER data

There are fifty-seven (57) genera from forty-one family of plants recorded in the area(Annex15). Among these plant communities, palms, ferns and bamboos are also present indicating the high species diversity of plants in the watershed area. Three (3) listed species found in the watershed area are highly vulnerable according to the International Union for the Conservation of Nature (IUCN) and DENR Administrative Order No. 1 series of 2007 are Agathisphilippinensis, Shoreapolysperma and Podocarpuspolystachysus.

2.2.2 FAUNA

High endemism and diversity of faunal species in Mag-Asawang Tubig Watershed is due to the existing good forest cover and habitat in the area. Three endemic species of bats were found in the area sampled located at Sub-watershed no. 2 (Kisloyan). These are shown in Table 17.

Table 17.List of faunal species identified in the area.

Species	Common Name	Status
BATS		
Cynopterisbrachyotis	Dog face fruit bat	Endemic
Pteropusleucopterus	Flying fox	Endemic
Macroglossuslogochilus	Long-tongued fruit bat	
Rossetusamplexicaudatus	Rosette fruit bat	
Ptenochinusjagori	Dog faced fruit bat	Endemic
BIRDS		
Laniuscristatus	Brown shrike	Migratory
Dicrurus sp.	Drongo	
SKUNK		
Sphenomorphusjagori	Jagor'sSphenomorphus	Endemic
RAT		
Rattuseveretti	Everett's rat	Luzon endemic

Source: Intex Resources Philippines, Inc as cited in Vendiola (undated)

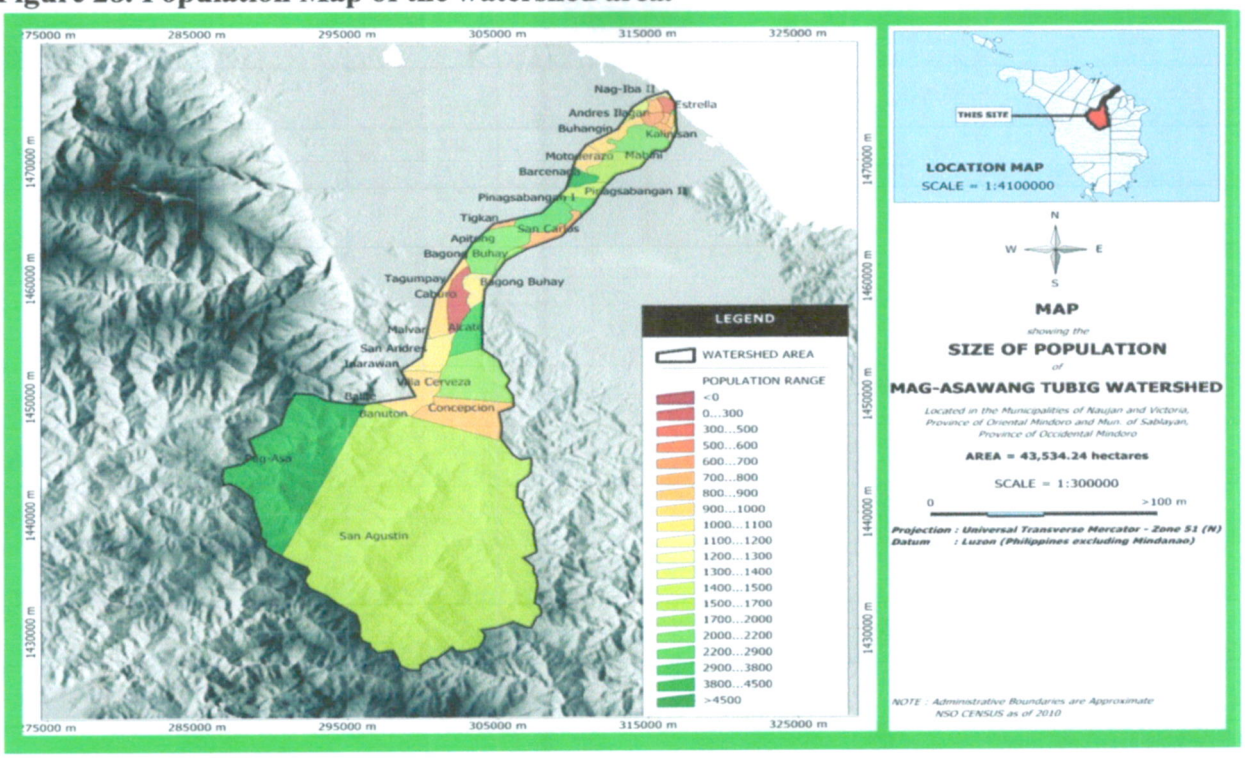
2.3 SOCIO-ECONOMIC SURVEY AND DEMOGRAPHY

In the actual site of the catchment basin, communities are located outsidethe area but these communities were included in the demographic characterization especially those located along the river bank of Mag-asawangTubig river. This is mainly because they benefitted directly to the good and services providedby the said watershed.

2.3.1 POPULATION AND DENSITY

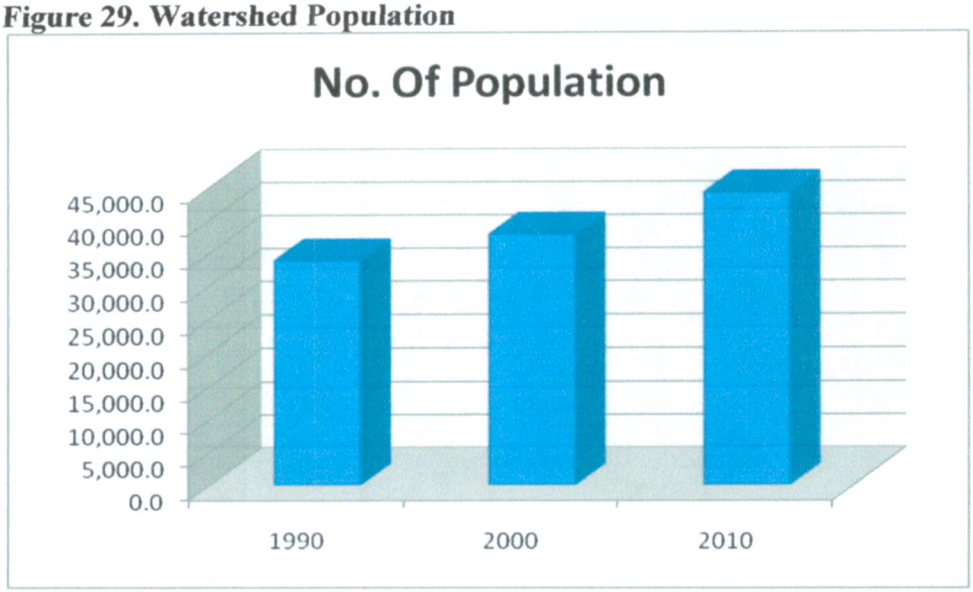
2010 population inside in the Mag-asawangtubig watershed is estimated to be around 44,471 individuals distributed in 27 number of barangays from the Municipalities ofSablayan, Occidental Mindoro (2), Naujan (22) and Victoria (3), Oriental Mindoro(Figure 28). Figure 29 shows the trends of increase of populations inside the watershed area. Most of these populations inside the watershed are located in the Municipality of Naujan. The population density in the watershed is computed to be 0.98 person per hectare.

Figure 28. Population Map of the watershed area.



Source: National Statistics Office (2010).

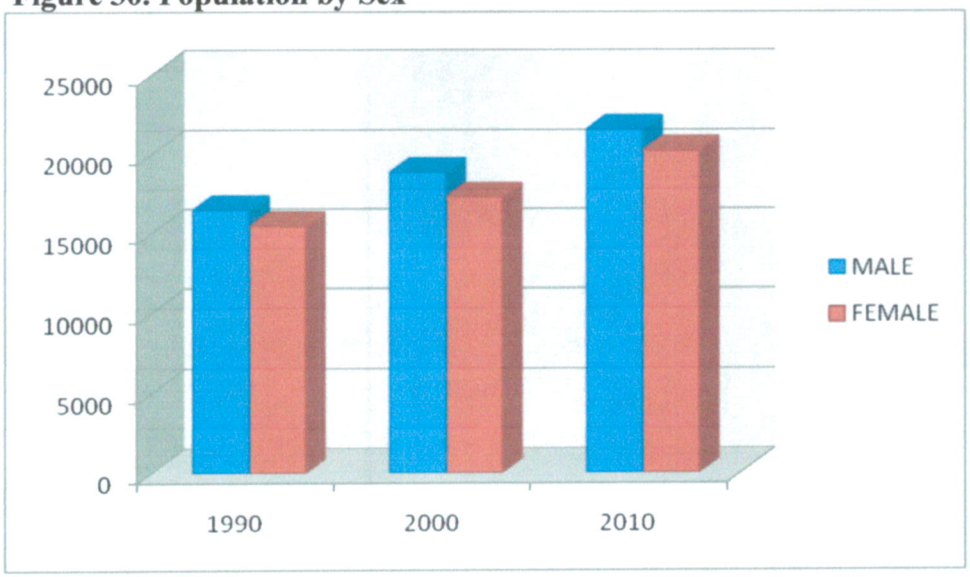
Figure 29. Watershed Population



Source : National Statistics Office

In 1990 and 2000 NSO Census of Populations, number of male is higher than female but in 2010 NSO Census of Populations female overtake male populations in terms of number (Figure 30).

Figure 30. Population by Sex

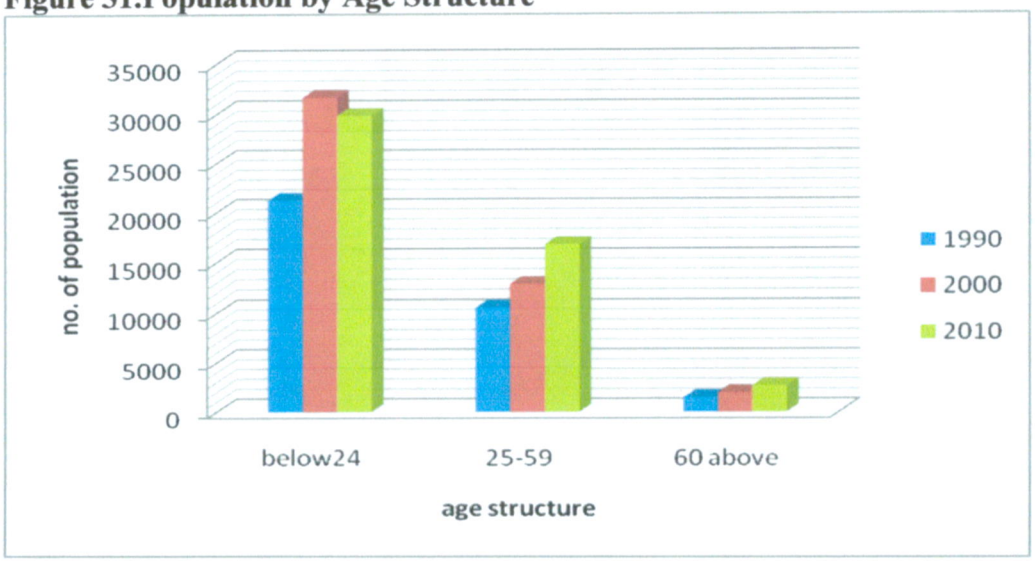


Source : National Statistics Office

2.3.2 AGE STRUCTURE

Bulk of the population falls in the age structure of 24 years and below. In this age bracket, young age in the area belongs with. While for the household population 60 and above it is quite interesting to note that in this age bracket, number of population decreases (Figure 31).

Figure 31.Population by Age Structure

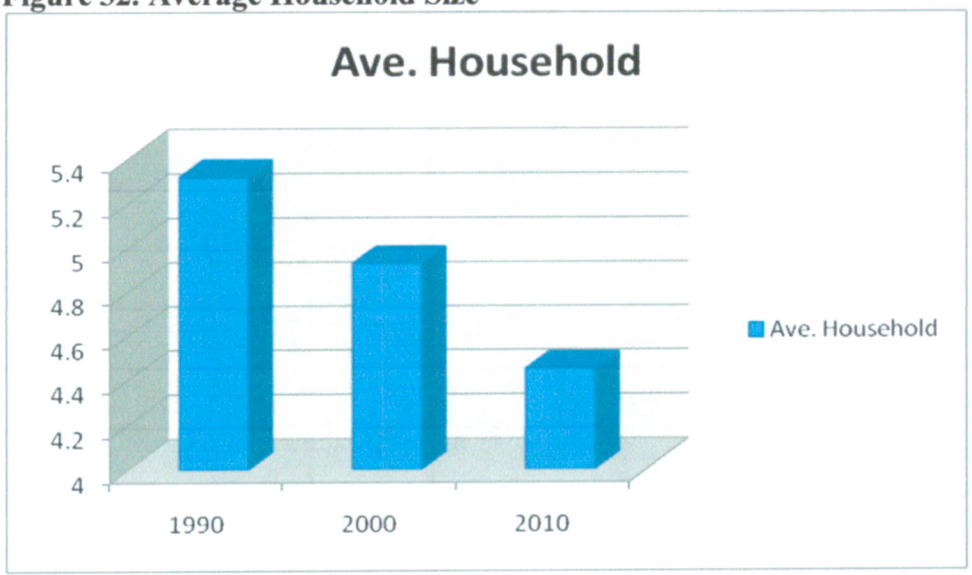


Source : National Statistics Office

2.3.3 HOUSEHOLD/FAMILY SIZE

In 2010, the recorded totalhouseholdspresent in the watershed area has a total of 9842. These households have a corresponding 44,471 number of individuals (Annex 7). Average household size in the watershed is 4.60 person per household (Figure 32).

Figure 32. Average Household Size



Source : National Statistics Office

2.3.4 LIVELIHOOD AND INCOME/PROFILE/SOURCES

Majority of the people in the area derived their income from agriculture although there are few who also derived income from other sources such as the services sector but still bulk of them sources their income from agriculture sector.

2.3.5 SECTORAL PRODUCTION

Agricultural sector has the biggest production in the area especially frompalay or rice.

2.3.6 EMPLOYMENT PATTERN AND PROJECTION

While development and modernization of adjacent towns and provinces are in fast pace trends as noted in the provinces of Batangas and Laguna, projection of the employment for the next ten years indicates that the residents in the area still will be deriving their income and livelihood from agriculturalsector.

2.3.7. SOCIAL, EDUCATIONAL, AND MEDICALSERVICES

A. Education

All barangays in the watershed area has elementary school while there are only secondary schools strategically located. This give the residents of an equal access and opportunity in education.

Tertiary schools is present in Naujan and Victoria. One of this is Mindoro State University located at Brgy. Alcate, Victoria, Oriental Mindoro while in Naujan, Naujan Technical College is also present offering mostly vocational courses .

More females than males had attained higher levels of education as majority of those with academic degrees were females (NSO, 2007).

B. Health

Medical services are provided by Municipal Hospitals in the town proper.Barangay Health Workers assisted the residents in delivering basic health services in the locality.

C. Social Services

Municipal Social Welfare and Development Office is the leading unit of local government in providing basic social services to the community. This unit of the local government give care, protection and empowered the socially, economically and physically disadvantage sectors in the municipality

Leading morbidity in the area are pneumonia respiratory infection and parasitism. There was also a high incidence of diseases like cardio-diseases that are considered diseases of the lifestyle.

2.3.8 TRANSPORTATION AND COMMUNICATION

A. Transportations

The watershed area is accessible by means of land transport vehicle through the Barangay road network but upon reaching the upland area, man-made trail is the only available way to reach the inner watershed area.

B. Communications

Modernization had brought communications in the area through the cellular phone where there are signals but in the inner most of the watershed area, signal is not available hence no available communication.

2.3.9 TOURISM AND RECREATION

A. Tourism

The watershed area still possess its natural lust and beauty though no man made structure for tourism purposes is present but still the area is ideal for nature lover.

B. Recreation

Natural river system is the available recreation in the watershed area. Pristine water from the mountain drain downward to this river.

2.3.10 RELIGIOUS SECTORS, POLITICAL, ANDSOCIAL ORGANIZATION

A. Religious

Based on the 2010 record of National Statistics Office, Roman Catholic has the biggest members in terms of followers and the rest are members of other religious sect such as Iglesiani Cristo, Protestant and Aglipay to name a few.

B. Social Organization

The social organization existing in the area is through kinship and family ties, a norms and tradition of the Filipino people.

C. Political Subdivision

Political subdivision in the area is through barangay boundaries.

D. Citizen Participation

The local barangay officials are the leading group that provided direction and leading the communities in the area whenever there are issues concern that needed be disseminated to the residents in the watershed area.

E. Ancestral Domain Claims

There are portions of the watershed that falls within the CADC area. The Alangan tribe of Mangyan is the one occupying the said CADC area inside the watershed.Approximatelythis is around 10,816.54 hectares.

2.3.11 BEHAVIORAL AND CULTURAL PATTERNS

Since the populations in the watershed area are combinations of different migrants and mangyan folks, each one of these group practice their traditional life and culture unique to them. The issues being common to them is the operation of mining company in the watershed area. Opposition for this mining project had crossed religious, cultural and political group.

III. VULNERABILITY ASSESSMENT

Vulnerability assessment of Mag-asawangTubig area adopted the parameters prepared by Dr. Antonio Daño (Annexes 16,17 and 18).

The following scale were used to assess the vulnerability of each Sub-watershed, to wit:

a. 1 - Very low
b. 2 – Low
c. 3 – Moderate
d. 4 – High
e. 5 – Very High

Table 18 and 19 shows the result of the vulnerability of this watershed area. All sub-watershed area are found to be highly vulnerable to the landslide due to the frequency of typhoon occurrences,location of fault lines inside the watershed and the soil morphology.

In terms of biodiversity, there are three listed species found to be endemic in the site hence it is also classified as highly vulnerable (Annex 15).

However, flooding in the catchment area is very low but in the communities in the lowland particularly in the river bank, they are highly prone to flooding (Figure 11).

Table 18. Summary of Sub-Watershed Vulnerability

PARAMETERS	SUB-WATERSHED						
BIO-PHYSICAL CHARACTERISTICS	SW1	SW2	SW3	SW4	SW5	SW6	SW7
1. Slope (30%)	1	2	3	3	2	3	3
2. Climate (10%)							
a. Monthly Rainfall (7%)	3	3	3	3	3	3	3
b. Typhoon Frequency (3%)	5	5	5	5	5	5	5
3. Soils (15%)							
a. Morphology (5%)	5	4	4	4	4	4	4
b. Erosion (10%)	2	2	2	2	2	2	2
4. Geology (3%)	1	1	1	1	1	1	1
5. Geo-Hazards (40%)							
a. Faultlines (20%)	5	5	5	5	5	5	5
b. Earthquake triggered Landslide susceptibility (10%)	1	1	1	1	1	1	1
c. Rain-induced landslide susceptibility (10%)	1	1	1	1	1		1
6. Vegetative Cover (2%)	2	2	2	2	2	2	2

Table 19. Weighted Summary of Vulnerability Rating

PARAMETERS	SUB-WATERSHED						
BIO-PHYSICAL CHARACTERISTICS	SW1	SW2	SW3	SW4	SW5	SW6	SW7
1. Slope	0.30	0.60	0.90	0.90	0.90	0.90	0.90
2. Climate	0.36	0.36	0.36	0.36	0.36	0.36	0.36
3. Soils	0.45	0.40	0.40	0.40	0.40	0.40	0.40
4. Geology	0.03	0.03	0.03	0.03	0.03	0.03	0.03
5. Geo-Hazards	1.20	1.20	1.20	1.20	1.20	1.20	1.20
6. Vegetative Cover	0.04	0.04	0.04	0.04	0.04	0.04	0.04
TOTAL RATING	2.38	2.63	2.93	2.93	2.93	2.93	2.93
VULNERABILITY CLASS	LOW	LOW	LOW	LOW	LOW	LOW	LOW

IV. ANALYSES OF ENVIRONMENTAL ISSUES, PROBLEMS ANDOPPORTUNITIES

Human populations are vital both for the protection and conservation of our natural resources. Utilization and consumption of our resources must be sustainable to attain a good balance of our ecosystem.

Several constraints, issues and opportunities are being faced by our natural resources that brought pressure and dilemma to its very existence.

A. Forest Ecosystem/Upland Ecosystem

Lack of opportunity, poverty and demand for more spaces for land development had causes the continued destruction of our upland resources particularly the forest. Rampant cutting of trees within the Mag-asawangTubig had been noted with the several confiscations and apprehensions of the last few years indicating that despite the calamities brought by destroyed forest, still they are neglecting the worst effect of forest loss. Not only the loss of forest cover being affected, biological diversity or biodiversity are also being displaced.

Proper management of the Mag-asawangTubig watershed area is timely and needed in order to save what is remain of its natural features and functions vital both to human existence and survival.

B. Grassland Ecosystem

MagasawangTubig is characterized with a good vegetation cover and few areas with grassland however if the rampant destruction will not be stopped. We may wake-up in one morning that this beloved forest land will no longer be as vegetated before but instead will be dominated with grasses.

C. Lowland/Urban Ecosystem

Communities in the watershed are found not in the catchment basin since this area is mountainous and far from the heart of the City thus they are found in the land downward. However, these human populations are near the forest inside the watershed exploitation and utilization of the resources found therein are mostly instigated by these people whether it is destructive or not. Conservation and preservation lies in their hand but still it is the duty of our government to be the vanguard of these resources.

D. Coastal and Marine Ecosystem

Small portion of this watershed has the coastal areas which happened to be the Estrella bay and with Marine resources but still it is important that we need to protect the species in the said area. Especially the mangrove trees that area habitat for fishes.

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Annex 1. Household population, 1990				
A. Naujan, Oriental Mindoro	Total Population	Total Household Population	Total No. Of Household	Ave. Household
Apitong	1,585	1,585	305	5.20
Bagong Buhay	1,090	1,090	191	5.71
Barcenaga	2,505	2,499	470	5.32
Buhangin	731	731	145	5.04
Concepcion	954	954	173	5.51
Estrella	1,827	1,827	350	5.22
Inarawan	1,315	1,315	256	5.14
Kalinisan	1,070	1,070	206	5.19
Mabini	350	350	65	5.38
Andres Ilagan (Mag-asawang Tubig)	532	532	103	5.17
Malvar	1,154	1,154	203	5.68
Motoderazo	1,172	1,172	241	4.86
Nag-Iba II	1,256	1,256	264	4.76
Pinagsabangan I	1,559	1,559	286	5.45
Pinagsabangan II	1,485	1,485	311	4.77
San Andres	1,068	1,068	190	5.62
San Antonio	510	510	97	5.26
San Carlos	858	858	163	5.26
Tagumpay	795	795	148	5.37
Tigkan	708	708	117	6.05
Balite	436	436	115	3.79
Banuton	276	276	71	3.89
Caburo	225	225	50	4.50
B. Victoria, Oriental Mindoro				
Alcate	3,173	3,172	566	5.60
Bagong Buhay	1,644	1,644	296	5.55
Villa Cerveza	1,176	1,176	216	5.44
C. Sablayan, Occidental Mindoro				
San Agustin	1,169	1,169	235	4.97
Pagasa	3,155	3,155	810	3.90

Source: National Statistics Office, *1990 Census of Population and Housing*

Annex 2. Household Population by Age Groupand Sex

Location	Below 24 years old		25-59 years old		Above 60 years old	
	Male	Female	Male	Female	Male	Female
A. Naujan, Oriental Mindoro						
Apitong	520	522	245	227	32	39
Bagong Buhay	383	337	166	165	25	14
Barcenaga	768	809	409	407	51	55
Buhangin	219	213	125	130	24	20
Concepcion	309	305	153	132	24	31
Estrella	596	530	304	304	39	54
Inarawan	466	384	209	190	31	35
Kalinisan	359	310	173	163	33	32
Mabini	120	109	60	46	6	9
Andres Ilasan	173	132	98	97	15	17
Malvar	414	394	166	154	14	12
Motoderazo	395	333	196	184	30	34
Nag-iba II	384	367	217	207	32	49
Pinagsabangan I	511	507	255	221	30	35
Pinagsabangan II	451	423	271	241	38	61
San Andres	375	362	157	137	17	20
San Antonio	174	147	80	85	15	9
San Carlos	282	267	137	140	17	15
Tagumpay	279	251	122	110	19	14
Tigkan	238	241	105	100	14	10
Balite	111	136	101	79	4	5
Banuton	113	97	36	28	1	1
Caburo	72	75	36	27	8	7
B. Victoria, Oriental Mindoro						
Alcate	1,094	1,015	488	454	62	59
Bagong Buhay	585	510	242	240	42	25
Villa Cerveza	376	395	192	160	30	23
C. Sablayan, Oriental Mindoro						
San Agustin	391	346	222	170	22	18
Pagasa	954	936	617	543	52	53

Source: National Statistics Office, *1990 Census of Population and Housing*

Annex 3. 1990 POPULATION BY SEX

Location	Both Sexes	Male	Female
A. Naujan, Oriental Mindoro			
Apitong	1,585	797	788
Bagong Buhay	1,090	574	516
Barcenaga	2,499	1,228	1,271
Buhangin	731	368	363
Concepcion	954	486	468
Estrella	1,827	939	888
Inarawan	888	490	398
Kalinisan	1,070	565	505
Mabini	350	186	164
Andres Ilagan (Mag-asawang Tubig)	532	286	246
Malvar	1,154	594	560
Motoderazo	1,172	621	551
Nag-Iba II	1,256	633	623
Pinagsabangan I	1,559	796	763
Pinagsabangan II	1,485	760	725
San Andres	1,068	549	519
San Antonio	510	269	241
San Carlos	858	436	422
Tagumpay	795	420	375
Tigkan	708	357	351
Balite	436	216	220
Banuton	276	150	126
Caburo	225	116	109
Victoria, Oriental Mindoro			
Alcate	3,172	1,644	1,528
Bagong Buhay	1,644	869	775
Villa Cerveza	1,176	598	578
Sablayan, Occidental Mindoro			
San Agustin	1,169	635	534
Pagasa	2,263	1,181	1,082

Source: National Statistics Office, *1990 Census of Population and Housing*

Annex 4. Household Population inside the Watershed, 2000

Area	Total Population	Household Population	Number of Households	Average Household Size
A. Naujan, Oriental Mindoro				
Apitong	2,058	2,058	407	5.06
Bagong Buhay	1,359	1,359	261	5.21
Barcenaga	3,779	3,779	738	5.12
Buhangin	749	749	178	4.21
Concepcion	963	963	186	5.18
Inarawan	1,562	1,561	314	4.97
Estrella	2,241	2,241	457	4.90
Kalinisan	1,180	1,180	247	4.78
Mabini	430	430	87	4.94
Andres Ilagan	581	581	108	5.38
Malvar	1,073	1,073	213	5.04
Motoderazo	1,537	1,537	330	4.66
Nag-Iba II	1,308	1,308	286	4.57
Pinagsabangan I	1,772	1,772	348	5.09
Pinagsabangan II	2,157	2,157	437	4.94
San Andres	894	894	163	5.48
San Antonio	394	394	89	4.43
San Carlos	639	639	119	5.37
Tagumpay	806	806	142	5.68
Tigkan	694	694	138	5.03
Balite	581	581	137	4.24
Banuton	696	696	155	4.49
Caburo	302	302	84	3.60
B. Victoria, Oriental Mindoro				
Alcate	3,209	3,182	610	5.22
Bagong Buhay	929	929	185	5.02
Villa Cerveza	1,438	1,438	299	4.81
C. Sablayan, Occidental Mindoro				
San Agustin	1,099	1,099	226	4.86
Pagasa	3,661	3,661	710	5.16

Source: National Statistics Office, 2000 *Census of Population and Housing*

Annex 5. 2000 Household Population by Age Groupand Sex.

Location	Below 24 years old		25-59 years old		Above 60 years old	
	Male	Female	Male	Female	Male	Female
A. Naujan, Oriental Mindoro						
Apitong	646	634	348	335	47	48
Bagong Buhay	1,178	1,011	230	209	32	36
Barcenaga	2,988	3,014	678	681	100	97
Buhangin	211	197	142	133	34	32
Concepcion	300	295	164	151	24	29
Estrella	672	637	423	393	53	63
Inarawan	511	463	277	235	34	42
Kalinisan	383	303	204	201	43	46
Mabini	127	125	78	75	14	11
Andres Ilagan (Mag-asawang Tubig)	193	162	96	86	22	22
Malvar	359	335	180	152	27	20
Motoderazo	489	401	278	284	41	44
Nag-Iba II	366	365	239	242	43	53
Pinagsabangan I	476	412	482	297	63	42
Pinagsabangan II	679	613	364	358	59	85
San Andres	309	279	141	120	23	22
San Antonio	108	107	72	76	15	16
San Carlos	221	177	111	104	12	14
Tagumpay	278	250	126	128	12	12
Tigkan	210	196	127	122	22	17
Balite	195	179	103	87	10	7
Banuton	215	218	142	98	17	6
Caburo	103	89	51	51	7	1
B. Victoria, Oriental Mindoro						
Alcate	1,075	951	520	498	83	82
Bagong Buhay	286	263	164	165	23	28
Villa Cerveza	469	430	248	203	47	41
Sablayan, Oriental Mindoro						
San Agustin	379	332	181	160	26	21
Pagasa	3137	2865	635	552	74	59

Source: National Statistics Office, 2000 *Census of Population and Housing*

Annex 6. 2000 Household Populations by sex

Naujan, Oriental Mindoro	Total	Male	Female
Apitong	2,058	1,041	1,017
Bagong Buhay	1,359	720	639
Barcenaga	3,779	1,883	1,896
Buhangin	749	387	362
Concepcion	963	488	475
Estrella	2,241	1,148	1,093
Inarawan	1,118	596	522
Kalinisan	1,180	630	550
Mabini	430	219	211
Andres Ilagan (Mag-asawang Tubig)	581	311	270
Malvar	1,073	566	507
Motoderazo	1,537	808	729
Nag-Iba II	1,308	648	660
Pinagsabangan I	1,772	1,021	751
Pinagsabangan II	2,157	1,101	1,056
San Andres	894	473	421
San Antonio	394	195	199
San Carlos	639	344	295
Tagumpay	806	416	390
Tigkan	694	359	335
Balite	581	308	273
Banuton	696	374	322
Caburo	302	161	141
VICTORIA, ORIENTAL MINDORO			
Alcate	3,209	1,678	1,531
Bagong Buhay	929	473	456
Villa Cerveza	1,438	764	674
SABLAYAN, OCCIDENTAL MINDORO			
San Agustin	1,099	586	513
Pagasa	2,577	1,372	1,205

Source: National Statistics Office, 2000 *Census of Population and Housing*

Annex 7. Household population in the watershed area, 2010

Area	Total Population	Household Population	Number of Households	Average Household Size
A. Naujan, Oriental Mindoro				
Apitong	2,189	2,189	464	4.72
Bagong Buhay	1,979	1,979	432	4.58
Barcenaga	4,545	4,545	992	4.58
Buhangin	905	905	222	4.08
Concepcion	869	869	205	4.24
Estrella	2,036	2,036	525	3.88
Inarawan	1,743	1,743	388	4.49
Kalinisan	1,194	1,194	274	4.36
Mabini	568	568	136	4.18
Andres Ilagan (Mag-asawang Tubig)	605	605	152	3.98
Malvar	1,105	1,105	240	4.60
Motoderazo	1,672	1,672	400	4.18
Nag-Iba II	1,302	1,302	329	3.96
Pinagsabangan I	2,239	2,233	504	4.43
Pinagsabangan II	1,474	1,459	480	3.04
San Andres	1,062	1,062	234	4.54
San Antonio	451	451	107	4.21
San Carlos	770	770	171	4.50
Tagumpay	954	953	192	4.96
Tigkan	785	785	161	4.88
Balite	1,040	1,040	214	4.86
Banuton	944	944	211	4.47
Caburo	274	274	63	4.35
B. Victoria, Oriental Mindoro				
Alcate	3,756	3,756	800	4.70
Bagong Buhay	1,077	1,077	238	4.53
Villa Cerveza	1,952	1,952	419	4.66
C. Sablayan, Occidental Mindoro				
San Agustin	1,529	1,529	315	4.85
Pagasa	5,452	5,452	974	5.60

Source: National Statistics Office, 2010 *Census of Population and Housing*

Annex 8. Household Population by Age Groupand Sex.

Location	Below 24 years old		25-59 years old		Above 60 years old	
	Male	Female	Male	Female	Male	Female
A. Naujan, Oriental Mindoro						
Apitong	570	522	505	408	53	71
Bagong Buhay	609	522	380	373	46	49
Barcenaga	1322	1210	864	857	120	177
Buhangin	238	259	175	155	35	43
Concepcion	236	224	174	167	25	43
Estrella	522	494	427	442	71	80
Inarawan	514	473	335	312	56	53
Kalinisan	343	280	244	230	44	53
Mabini	156	138	125	114	19	16
Andres Ilagan (Mag-asawang Tubig)	148	153	115	127	25	37
Malvar	236	314	210	174	38	33
Motoderazo	471	416	339	327	45	72
Nag-Iba II	352	309	258	258	53	72
Pinagsabangan I	629	590	470	413	59	80
Pinagsabangan II	318	283	380	370	59	64
San Andres	312	300	255	180	32	33
San Antonio	108	129	89	87	14	24
San Carlos	225	204	152	139	23	27
Tagumpay	311	263	174	163	16	27
Tigkan	210	217	158	143	29	28
Balite	339	327	181	161	17	15
Banuton	323	311	154	125	17	14
Caburo	81	97	47	40	6	3
B. Victoria, Oriental Mindoro						
Alcate	1131	989	729	677	106	124
Bagong Buhay	300	278	220	209	28	42
Villa Cerveza	624	594	356	296	49	33
C. Sablayan, Oriental Mindoro						
San Agustin	502	440	281	225	47	34
Pagasa	4405	4250	1045	972	126	106

Source: National Statistics Office, 2010 *Census of Population and Housing*

Annex 9. Household Population by Sex

Name of Barangay	Total	Male	Female
A. Naujan, Oriental Mindoro			
Apitong	2189	1128	1061
Bagong Buhay	1979	1035	944
Barcenaga	4545	2306	2239
Buhangin	905	448	457
Concepcion	869	435	434
Estrella	2036	1020	1016
Inarawan	903	473	430
Kalinisan	1194	631	563
Mabini	568	300	268
Andres Ilagan (Mag-asawang Tubig)	605	288	317
Malvar	1105	584	521
Motoderazo	1672	855	817
Nag-Iba II	1302	663	639
Pinagsabangan I	2239	1156	1083
Pinagsabangan II	1474	757	717
San Andres	1062	549	513
San Antonio	451	211	240
San Carlos	770	400	370
Tagumpay	954	501	452
Tigkan	785	397	388
Balite	1040	537	503
Banuton	944	494	450
Caburo	274	134	140
B. Victoria, Oriental Mindoro			
Alcate	3576	1966	1790
Bagong Buhay	1077	548	529
Villa Cerveza	1952	1029	923
C. Sablayan, Occidental Mindoro			
San Agustin	1529	830	699
Pagasa	4,068	2,109	1,959

Source: National Statistics Office, 2010 *Census of Population and Housing*

Annex 10. Monthly and annual rainfall (2003-2012

MONTHLY TOTAL AND ANNUAL CLIMATIC DATA (RAINFALL IN mm)

)N: CALAPAN CITY

YEAR	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
2003	78.4	14.1	14.7	30.6	206.0	145.9	297.2	133.9	192.6	287.3	373.2	109.5	1883.4
2004	96.0	46.4	8.9	11.1	482.7	228.0	216.2	173.7	81.0	319.9	166.1	77.3	1907.3
2005	96.9	51.0	30.2	28.3	22.5	353.8	203.3	292.5	150.6	581.0	160.6	501.6	2472.3
2006	152.8	56.6	241.9	58.4	352.8	670.1	191.0	200.6	235.7	113.2	229.8	344.3	2847.2
2007	101.1	12.3	97.6	28.0	250.0	522.4	173.2	149.0	263.1	296.8	240.5	75.8	2209.8
2008	399.8	154.3	27.8	291.6	303.8	260.5	110.3	63.8	318.2	243.8	999.2	106.4	3279.5
2009	64.6	40.0	91.0	322.6	447.6	186.2	166.8	94.8	257.6	177.0	110.8	48.8	2007.8
2010	56.2	1.1	84.2	76.0	76.2	209.1	440.0	174.7	369.4	580.5	528.1	163.6	2759.1
2011	93.8	32.2	63.0	65.5	189.7	421.0	268.4	353.3	103.4	393.4	393.2	405.1	2782.0
2012	135.6	171.7	320.0	154.8	11.0	68.1	509.4	259.1	257.7	442.4	88.7	200.6	2619.1
TOTAL	1275.2	579.7	979.3	1066.9	2342.3	3065.1	2575.8	1895.4	2229.3	3435.3	3290.2	2033.0	24767.5
MEAN	127.52	57.9	97.9	106.69	234.2	306.51	257.58	189.54	222.93	343.53	329.02	203.3	247.67

SOURCE:PAGASA-DOST

Annex 11. Maximum Temperature (2003-2012)

MAXIMUM TEMPERATURE

N: CALAPAN CITY

YEAR	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
2003	30.0	31.3	32.0	33.6	33.1	32.3	32.5	32.5	32.3	31.9	31.7	28.4	31.8
2004	30.1	30.4	32.1	33.9	32.8	31.6	32.1	31.8	32.7	31.4	30.6	29.7	31.6
2005	29.0	30.4	31.4	33.0	34.0	33.2	32.5	31.3	31.4	31.4	31.2	28.4	31.4
2006	29.2	29.4	30.9	31.8	31.8	32.0	31.2	30.8	32.5	31.5	31.7	29.5	31.0
2007	29.1	29.9	30.9	32.8	32.9	32.5	32.5	31.9	31.7	30.8	29.9	30.0	31.2
2008	29.5	28.9	30.7	31.7	31.6	31.2	31.6	31.8	31.6	31.7	30.2	28.9	30.8
2009	28.0	30.1	31.9	31.5	31.1	31.4	31.5	32.2	30.6	30.9	30.2	28.9	30.7
2010	28.1	30.6	31.1	32.6	33.5	33.6	31.6	31.4	31.2	30.4	30.2	29.4	31.1
2011	28.4	28.9	29.4	31.0	32.4	31.0	31.1	31.0	31.8	31.0	30.4	29.7	30.5
2012	29.6	29.9	30.8	33.3	34.1	33.7	31.5	31.1	31.2	31.0	31.6	29.9	31.5
TOTAL	291.0	299.8	311.2	325.2	327.3	322.5	318.1	315.8	317.0	312.0	307.7	292.8	311.6
MEAN	29.1	29.98	31.12	32.52	32.73	32.25	31.81	31.58	31.7	31.2	30.77	29.28	31.16

SOURCE:PAGASA-DOST

Annex 12. Minimum Temperature (2003-2012)

MINIMUM TEMPERATURE

)N: CALAPAN CITY

YEAR	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
2003	21.5	22.2	23.2	24.8	24.5	23.4	23.9	24.2	23.9	23.2	23.3	22.0
2004	22.4	22.5	23.6	24.9	24.4	24.2	23.9	23.9	23.8	22.6	23.6	22.9
2005	21.6	22.5	23.3	24..3	25.0	24.5	9.0	23.9	24.1	23.8	23.9	22.8
2006	22.8	23.1	23.8	25.1	24.9	24.6	24.5	24.1	23.4	23.3	23.9	23.5
2007	22.8	22.5	23.2	24.7	24.2	24.2	24.1	23.7	23.4	23.2	22.9	23.0
2008	22.3	21.6	22.9	23.6	23.7	23.7	24.0	24.1	23.9	24.1	23.4	23.0
2009	21.5	22.9	23.4	23.6	23.9	23.8	23.4	24.9	24.4	23.9	23.8	22.1
2010	22.3	22.7	23.4	23.8	24.2	23.9	23.0	23.3	23.3	23.5	23.2	22.9
2011	22.0	22.0	22.6	22.9	23.8	23.0	23.4	23.5	23.7	23.4	23.0	24.0
2012	22.9	22.8	23.1	23.7	24.1	24.1	23.4	23.4	23.5	23.1	23.4	22.7
TOTAL	222.1	224.8	232.5	217.1	242.7	239.4	222.6	239.0	237.4	234.1	234.4	228.9
MEAN	22.21	22.48	23.25	21.17	24.27	23.94	22.26	23.9	23.74	23.41	23.44	22.89

SOURCE:PAGASA-DOST

Annex 13. Relative Humidity (2003-2011)

RELATIVE HUMIDITY

)N: CALAPAN CITY

YEAR	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
2003	84.16	82.00	81.35	78.40	81.48	84.00	82.96	82.96	84.56	84.77	85.83	86.51
2004	86.00	87.32	81.64	77.03	81.51	85.53	85.06	85.06	82.36	85.41	86.70	86.61
2005	86.32	83.71	81.29	78.90	77.41	82.20	85.93	85.93	85.96	86.06	85.12	90.06
2006	86.84	84.36	83.06	78.87	80.70	82.30	85.12	85.12	84.83	83.77	83.66	85.77
2007	84.90	81.43	78.97	75.10	79.67	81.76	82.61	82.61	85.43	85.96	83.03	85.74
2008	85.55	87.50	80.35	80.67	82.61	81.68	82.19	82.19	83.40	85.74	84.85	86.51
2009	85.32	84.64	81.74	84.90	86.38	85.06	80.58	80.58	85.36	80.87	83.93	83.32
2010	88.32	83.54	87.29	83.97	83.29	84.10	83.83	83.83	84.83	86.81	88.93	85.90
2011	83.90	81.68	82.93	78.57	81.67	83.00	84.77	84.87	83.50	84.64	86.00	85.00
TOTAL	771.3	756.2	738.6	716.4	734.7	749.6	753.1	753.2	760.2	764.0	768.1	775.4
MEAN	85.7	84.02	82.06	79.6	81.63	83.29	83.68	83.69	84.47	84.89	85.34	86.16

SOURCE:PAGASA-DOST

Annex 14. List of faunal species identified in Kisloyan.

Species	Common Name	Status
BATS		
Cynopteris brachyotis	Dog face fruit bat	endemic
Pteropus leucopterus	Flying fox	endemic
Macroglossus logochilus	Long-tongued fruit bat	
Rossetus amplexi caudatus	Rosette fruit bat	
Ptenochinus jagori	Dog faced fruit bat	endemic
BIRDS		
Lanius cristatus	Brown shrike	migratory
Dicrurus sp.	Drongo	
SKUNK		
Sphenomorphus jagori	Jagor's Sphenomorphus	endemic
RAT		
Rattus everetti	Everett's rat	Luzon endemic

Source: Intex Resources Philippines, Inc

Annex 15. Enumeration of plant species found in the area.

Species Name	Family Name	Class	Ecological Status/Category /Remarks
Mangifera longipes	Anacardiaceae	Tree	Lowland primary and secondary forest;up to 400m altitude widely distributed
Buchanania microphylla	Anacardiaceae	Tree	Secondary forest at low altitude
Buchanania arborescens	Anacardiaceae	Tree	Lowland forest and secondary forest; Widely distributed
Buchanania arborescens	Anacardiaceae	Tree	Lowland forest and secondary forest; Widely distributed
Polyalthia barnesii	Annonaceae	Tree	small tree widely distributed
Polyalthia glauca	Annonaceae	Tree	Common
Polyalthia glauca	Annonaceae	Tree	Common
Mitrephora reflexa	Annonaceae	Tree	Common
Alstonia macrophylla	Apocynaceae	Tree	Open and primary forest: widely distributed
Alstonia macrophylla	Apocynaceae	Tree	Open and primary forest: widely distributed
Alstonia macrophylla	Apocynaceae	Tree	Open and primary forest: widely distributed
Alstonia macrophylla	Apocynaceae	Tree	Open and primary forest: widely distributed
Alyxia concatenata	Apocynaceae	Tree	Common
Calamus mindorensis	Palmae	Rattan	Endemic
Spatiphyllum commutatum	Araceae	Herb	Common
Agathis philippinensis	Araucariaceae	Tree	*Vulnerable ;DENR DAO No 2007-1; IUCN Plant List 2006
Pinanga philippinensis	Arecaceae	Palm	Endemic
Pinanga insignis	Palmae	Palm	Endemic

Asplenium haenkei	Aspleniaceae	Fern	Common
Asplenium haenkei	Aspleniaceae	Fern	Common
Blechnum orientale	Blechnaceae	Fern	Common
Canarium asperum var.asperum	Burseraceae	Free	Common
Dracaena angustifolia	Convallariceae	Shrub	Common
Dracaena angustifolia	Convallariceae	Shrub	Common
Scleria scrobiculata	Cyperaceae	Sedge	Common
Scleria scrobiculata	Cyperaceae	Sedge	Common
Dioscorea divaricara	Dioscoreaceae	Vine	Common
Shorea polysperma	Dipterocarpaceae	Tree	*Vulnerable species;Critically Endangered; DENR ADMINISTRATIVE ORDER No 2007-1; IUCN Plant List 2006
Shorea polysperma	Dipterocarpaceae	Tree	*Vulnerable species;Critically Endangered; DENR ADMINISTRATIVE ORDER No 2007-1; IUCN Plant List 2006
Shorea polysperma	Dipterocarpaceae	Tree	*Vulnerable species;Critically Endangered; DENR ADMINISTRATIVE ORDER No 2007-1; IUCN Plant List 2006
Shorea polysperma	Dipterocarpaceae	Tree	*Vulnerable species;Critically Endangered ;DENR ADMINISTRATIVE ORDER No 2007-1; IUCN Plant List 2006
Shorea polysperma	Dipterocarpaceae	Tree	*Vulnerable species;Critically Endangered; DENR

			ADMINISTRATIVE ORDER No 2007-1; IUCN Plant List 2006
Shorea polysperma	Dipterocarpaceae	Tree	*Vulnerable species;Critically Endangered; DENR ADMINISTRATIVE ORDER No 2007-1; IUCN Plant List 2006
Elaeocarpus mindorensis	Elaeocarpaceae	Tree	Endemic
Trigonostemon longipes	Euphorbiaceae	Tree	Common
Glochidion trichophorum	Euphorbiaceae	Tree	Endemic
Breynia cernua	Euphorbiaceae	Tree	Common
Breynia viti-ideae	Euphorbiaceae	Tree	Common
Breynia cernua	Euphorbiaceae	Tree	Common
Antidesma subcordatum	Euphorbiaceae	Tree	Endemic
Flagellaria indica	Flagellariaceae	Vine	Common
Flagellaria indica	Flagellariaceae	Vine	Common
Dicranopteris curanii	Gleicheniaceae	Fern	Common
Litsea fulva	Lauraceae	Tree	Common
Litsea fulva	Lauraceae	Tree	Common
Litsea fulva	Lauraceae	Tree	Common
Litsea philippinensis	Lauraceae	Tree	Common
Neolitsca vidalii	Lauraceae	Tree	Common
Neolitsea villosa	Lauraceae	Tree	Common
Litsea sebeifera	Lauraceae	Tree	Common
Fagraea auriculata ssp.auriculata	Loganiaceae	Tree	Common
Taenitis luzonica	Lomariopsidaceae	Fern	Common
Astronia williamsii	Melastomateceae	Tree	Endemic
Astronia cumingiana	Melastomateceae	Tree	Endemic

Melastoma setosa	Melastomateceae	Shrub	Common
Melastoma malabarichum	Melastomateceae	Shrub	Common
Aphanamixis polystachya	Meliaceae	Tree	Common
Ficus congesta	Moraceae	tree	Common
Ficus ruficaulis	Moraceae	tree	Common
Syzygium merritianum	Myrtaceae	tree	Common
Syzygium oleinum	Myrtaceae	tree	Common
Acmena acumnatissima	Myrtaceae	tree	Common
Syzygium mindorense	Myrtaceae	tree	Endemic
Syzygium mindorense	Myrtaceae	tree	Endemic
Pandanus gracilis	Pandanaceae	pandan	Common
Pandanus gracilis	Pandanaceae	pandan	Common
Frecynetia sphaerocephala	Pandanaceae	vine	Common
Padanus gracilis	Pandanaceae	pandan	Common
Pandanus gracilis	Pandanaceae	pandan	Common
Pandanus ensifolia	Pandanaceae	pandan	Common
Frecynetia sphaerocephala	Pandanaceae	pandan	Common
Alphitonia philippinensis	Phamnaceae	tree	Common
Alphitonia philippinensis	Phamnaceae	tree	Common
Piper inaequalis	Piperaceae	vine	Common
Piper merillii	Piperaceae	vine	Common
Dinochloa acutiflora	Poaceae	bamboo	Common
Dinochloa acutiflora	Poaceae/Gramineae	bamboo	Common
Dinochloa luconiae	Poaceae/Gramineae	bamboo	Common
Dinacholoa cutiflora	Poaceae/Gramineae	bamboo	Common
Dinochloa luconiae	Poaceae/Gramineae	bamboo	Common
Dinochloa luconiae	Poaceae/Gramineae	bamboo	Common

Podocarpus polystachyus	Podocarpaceae	tree	Common
Alphitonia philippinensis	Rhamnaceae	tree	Common
Alphitonia philippinensis	Rhamnaceae	tree	Common
Alphitonia philippinensis	Rhamnaceae	tree	Common
Prunus arborea var. arborea	Rosaceae	tree	Common
Prunus arborea var. arborea	Rosaceae	tree	Common
Lasianthus stipularis	Rubiaceae	shrub	Common
Mussaenda magallanensis	Rubiaceae	shrub	Common
Mussaenda magallanensis	Rubiaceae	shrub	Common
Mussaenda magallanensis	Rubiaceae	shrub	Common
Gardenia merrilii	Rubiaceae	shrub	Common
Mussaenda anisophylla	Rubiaceae	shrub	Common
Neonauclea reticulata	Rubiaceae	tree	Endemic
Lasianthus stipularis	Rubiaceae	shrub	Common
Palaquium obovatum	Sapotaceae	tree	Common
Pterocymbium tinctorium	Sterculiaceae	tree	Common
Ternstroemia gymnanthera	Theaceae	tree	Common
Gordonia sablayana	Theaceae	tree	Common
Leucocyke mindorensis	Urticaceae	tree	Endemic

Source: Vendiola, Undated

Annex 16. VULNERABILITY ASSESSMENT PARAMETERS FOR LANDSLIDES

(Source: Dr. Antonio Daño)

Bio-physical, Geological and Hydro-meteorological Factors

A. SLOPE

1. Slope		HazardRating
Slopes 0-8%	-	1
Slopes 8.1-18%	-	2
Slopes 18.1–30%	-	3
Slopes 30.1-50%	-	4
Slopes >50%	-	5

(NOTE: The succeeding parameters are integral in hazard rating. One (1) being the least vulnerable and 5 being the most vulnerable).

B. GEOLOGY AND SOILS

1. Soil Morphology

Troposamments with troporthents	- 1
Tropoquepts	- 2
Dystropepts-Hapludalfs Association	- 3
Mountain Soils w/ Entisols, Inceptisols, Ultisols and Alfisols	- 4
Tropudults with tropudalfs, oxisols	- 5

2. Geology

Paleocene	-	1
Neocene, Undifferentiated (sedimentary & metamorphic rocks)	-	2
Pliocene-Pleistocene	-	3
Oligocene-Miocene	-	4
Recent-quaternary; Plioliocene-quaternary	-	5

3. Erosion

Almost no active erosion	-	1
Slight sheet and rill; no gullying	-	2
Moderate sheet and rill; slight gully	-	3
Moderate sheet, rill & gully erosion	-	4
Severe sheet and rill erosion	-	5

4. Faultlines

Faultlines are not nearer than 5 kms from the watershed	-	1
Faultlines are within 4-4.9 kms	-	2
Faultlines are within 3-3.9 kms	-	3
Faultlines are within 2-2.9 kims	-	4
Faultlines within 1.9 kms from the watershed	-	5

5. Earthquake Triggered Landslides Susceptibility

Less than 20% of the area is susceptible	-	1
20-30% of the area is susceptible	-	2
31-50% of the area is susceptible	-	3
51-70% of the area is susceptible	-	4
71-100% of the area is susceptible	-	5

6. Rain Induced Landslides Susceptibility

< 20% of the area is susceptible	-	1
20-30% of the area is susceptible	-	2
31-50% of the area is susceptible	-	3
51-70% of the area is susceptible	-	4
71-100% of the area is susceptible	-	5

C. CLIMATE (20%)

1. Monthly Rainfall

<100 mm	-	1
100.1-200mm	-	2
200.1-300mm	-	3
300.1-500mm	-	4
>500mm	-	5

2. Typhoon Frequency(Annual Typhoon Incidence)

Very low frequency(not more than 1 typhoon in 3 years)	-	1
Low typhoon frequency(not more than 1 typhoon per year)	-	2
Moderate frequency (1 typhoon/year)	-	3
High frequency(2-3 typhoons/year)	-	4
Very High Frequency(more than 3 typhoons/year)	-	5

D. VEGETATION COVER

<20% open/grassland/bare/cultivated	-	1
21-30% open/grassland/bare/cultivated	-	2
30-49% open/grassland/bare/cultivated	-	3
50-70% open/grassland/bare/cultivated	-	4
>71% of the area is open/grassland/bare/cultivated	-	5

Annex 17. VULNERABILITY ASSESSMENT PARAMETERS FOR HAZARDS ON WATER QUALITY AND BIO-DIVERSITY LOSS

(Source: Dr. Daño)

Class	Loss of Water Quality	Biodiversity Loss
5(Very High)	>2 times the accepted level of hazardous chemical and/or coliform; Severe discoloration.	At least one(1) endangered spp., either flora or fauna
4(High)	1.5 to 2 times the accepted level of hazardous chemical and/or coliform; Severe discoloration.	Presence of 0 - 3 endemic species of flora and fauna
3(Moderately High)	1.01 to 1.5 times the accepted level of hazardous chemicals and/or coliform; Moderate discoloration.	Presence of 4 - 7 endemic species of flora and fauna
2(Low)	Within accepted level, hence, pose no risk to health.	Presence of 8 - 11 endemic species of flora and fauna
1(Very low)	No hazardous chemicals; no discoloration	Presence of more than 11 endemic species of flora and fauna

Annex 16. VULNERABILITY ASSESSMENT PARAMETERS FOR LANDSLIDES

(Source: Dr. Antonio Daño)

Bio-physical, Geological and Hydro-meteorological Factors

A. SLOPE

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Slopes 18.1–30%	-	3
Slopes 30.1-50%	-	4
Slopes >50%	-	5

(NOTE: The succeeding parameters are integral in hazard rating. One (1) being the least vulnerable and 5 being the most vulnerable).

B. GEOLOGY AND SOILS

1. Soil Morphology

Troposamments with troporthents	- 1
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Mountain Soils w/ Entisols, Inceptisols, Ultisols and Alfisols	- 4
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2. Geology

Paleocene	-	1
Neocene, Undifferentiated (sedimentary & metamorphic rocks)	-	2
Pliocene-Pleistocene	-	3
Oligocene-Miocene	-	4
Recent-quaternary; Plioliocene-quaternary	-	5

3. Erosion

Almost no active erosion	-	1
Slight sheet and rill; no gullying	-	2
Moderate sheet and rill; slight gully	-	3
Moderate sheet, rill & gully erosion	-	4
Severe sheet and rill erosion	-	5

4. Faultlines

Faultlines are not nearer than 5 kms from the watershed	-	1
Faultlines are within 4-4.9 kms	-	2
Faultlines are within 3-3.9 kms	-	3
Faultlines are within 2-2.9 kims	-	4
Faultlines within 1.9 kms from the watershed	-	5

5. Earthquake Triggered Landslides Susceptibility

Less than 20% of the area is susceptible	-	1
20-30% of the area is susceptible	-	2
31-50% of the area is susceptible	-	3
51-70% of the area is susceptible	-	4
71-100% of the area is susceptible	-	5

6. Rain Induced Landslides Susceptibility

< 20% of the area is susceptible	-	1
20-30% of the area is susceptible	-	2
31-50% of the area is susceptible	-	3
51-70% of the area is susceptible	-	4
71-100% of the area is susceptible	-	5

C. CLIMATE (20%)

1. Monthly Rainfall

<100 mm	-	1
100.1-200mm	-	2
200.1-300mm	-	3
300.1-500mm	-	4
>500mm	-	5

2. Typhoon Frequency(Annual Typhoon Incidence)

Very low frequency(not more than 1 typhoon in 3 years)	-	1
Low typhoon frequency(not more than 1 typhoon per year)	-	2
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High frequency(2-3 typhoons/year)	-	4
Very High Frequency(more than 3 typhoons/year)	-	5

D. VEGETATION COVER

<20% open/grassland/bare/cultivated - 1

21-30% open/grassland/bare/cultivated - 2

30-49% open/grassland/bare/cultivated - 3

50-70% open/grassland/bare/cultivated - 4

>71% of the area is open/grassland/bare/cultivated - 5

Annex 17. VULNERABILITY ASSESSMENT PARAMETERS FOR HAZARDS ON WATER QUALITY AND BIO-DIVERSITY LOSS

(Source: Dr. Daño)

Class	Loss of Water Quality	Biodiversity Loss
5(Very High)	>2 times the accepted level of hazardous chemical and/or coliform; Severe discoloration.	At least one(1) endangered spp., either flora or fauna
4(High)	1.5 to 2 times the accepted level of hazardous chemical and/or coliform; Severe discoloration.	Presence of 0 - 3 endemic species of flora and fauna
3(Moderately High)	1.01 to 1.5 times the accepted level of hazardous chemicals and/or coliform; Moderate discoloration.	Presence of 4 - 7 endemic species of flora and fauna
2(Low)	Within accepted level, hence, pose no risk to health.	Presence of 8 - 11 endemic species of flora and fauna
1(Very low)	No hazardous chemicals; no discoloration	Presence of more than 11 endemic species of flora and fauna

Annex 18. FLOOD VULNERABILITY PARAMETERS

(Source: Dr. Antonio Daño)

Flood Hazard Rating	Indicators
5(Very High)	- Areas flooded every 1 to 5 years.
4(Moderately High)	- Areas flooded at an average interval of 6 to 10 years.
3(Moderate)	- Areas flooded every 11 to 20 years.
2(Low)	- Areas flooded every 21 to 35 years.
1(Very Low)	- Areas that were not flooded for the past 35 years

Annex 19

Republic of the Philippines
PROVINCIAL AGRICULTURE OFFICE
Soils Laboratory Division
City of Calapan
PROVINCE OF ORIENTAL MINDORO

NAME OF FARMER/OFFICE: DENR-CENRO c/o Gina Santos

DATE ANALYZED: 06-13-2014

LOCATION OF FARM: Pinagsabangan/San Antonio, Naujan

DATE RECOMMENDED: 06-16-2014

pH	NUTRIENT STATUS (N-P-K)	NUTRIENT REQUIREMENT (kg/tree)	CROP	BEARING AGE (yrs.)	RECOMMENDED FERTILIZER	AMOUNT (gm/tree)	METHODS OF APPLICATION
7.2/ 7.6	L-H-D Nitrogen(N) = low Phosphorus(P) = High Potassium(K) = Deficient	 N = 0.01 P = 0.00 K = 0.01	Forest Trees	0 (seedlings)	Unang Paglalagay: Ammonium Sulfate(21-0-0) Muriate of Potash(0-0-60)	 48.0 gm/t 17.0 gm/t	Maglagay ng pataba 3-4 na pulgada sa tabi at 4-5 na pulgada sa ilalim sa panahon ng pagtatanim.

Certified by:

NESTOR M. DE GUZMAN
Agriculturist II

Approved by:

MODESTO C. LEYNES
Agricultural Center Chief II

Annex 19

Republic of the Philippines
PROVINCIAL AGRICULTURE OFFICE
Soils Laboratory Division
City of Calapan
PROVINCE OF ORIENTAL MINDORO

NAME OF FARMER/OFFICE: DENR-CENRO c/o Gina Santos

DATE ANALYZED: 06-13-2014

LOCATION OF FARM: Villa Cerveza, Victoria

DATE RECOMMENDED: 06-16-2014

pH	NUTRIENT STATUS (N-P-K)	NUTRIENT REQUIREMENT (kg/tree)	CROP	BEARING AGE (yrs.)	RECOMMENDED FERTILIZER	AMOUNT (gm/tree)	METHODS OF APPLICATION
6.8	L-M-D Nitrogen(N) = low Phosphorus(P) = Medium Potassium(K) = Deficient	 N = 0.01 P = 0.01 K = 0.01	Forest Trees	0 (seedlings)	Unang Paglalagay: Complete(14-14-14)	71.0 gm/t	Maglagay ng pataba 3-4 na pulgada sa tabi at 4-5 na pulgada sa ilalim sa panahon ng pagtatanim.

Certified by:

NESTOR M. DE GUZMAN
Agriculturist II

Approved by:

MODESTO C. LEYNES
Agricultural Center Chief II

Annex 20

F.A.S.T. Laboratories
The First Analytical Services And Technical Cooperative
TECHNICAL EXCELLENCE • INTEGRITY • QUALITY SERVICE • SOCIAL RESPONSIBILITY

F.A.S.T. Laboratories – Calamba
Km. 54 Brgy. Makiling, Calamba City, Laguna

TEST REPORT

Reference No.: **CL1406-1447**

CUSTOMER	: DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES
ADDRESS	: DENR-CENRO Socorro, Pasi 2 Socorro Oriental
SAMPLE(S) RECEIVED	: RIVER WATER
SAMPLE CODE	: CL1406-1447-01
Date / Time of Sampling	: 10 June 2014 / 09:00 AM (By customer)
Date / Time Received	: 11 June 2014 / 10:05 AM
Date Analyzed	: 11 June 2014
Analyst / s	: Carmela N. Ocaya / April-Ross B. Espina
Date Reported	: 26 June 2014

Parameter	Unit	Result	Test Method
pH	-	8.0 @ 18.5 °C	Electrometry
Temperature	°C	18.5	Thermometer
COD	mg/L	28	Closed Reflux / Titrimetric
Calcium	mg/L	55.8	Titrimetric Method
Nitrates	mg/L	1.0	Bruccine Method
Phosphates	mg/L	0.21	Colorimetric Method
Conductivity	mS/cm	6.3	Conductivity Meter
Salinity	S°/₀₀	Less than 3.64[y]	Argentometric Method

Note: [y] Reporting Limit

Reference: APHA-AWWA and WEF 2005/2012. Standard Methods for the Examination of Water and Wastewater, 21st and 22nd Ed. Official Method of Analysis AOAC International 18th Edition.

Results are those obtained at the time of examination and relate only to the sample/s tested.

CERTIFIED BY:
ASMAH Y. PATACPAN
Laboratory Chemist
Chem.Reg.No.10595

APPROVED BY:
EVANGELINE B. VALDEZ
Laboratory Manager
Chem.Reg.No.07662

MAG- ASAWANG TUBIG WATERSHED COORDINATION

Coordination with MPDO CAROLINE G.MANUEL OF MUNICIPALITY of Victoria, or. mdo

Coordination with OIC/MPDC RAQUELITA M.UMALI of Municipality of Naujan, Or. Mdo

Coordination with Brgy. Official in Brgy. Alcate Victoria Or. Mdo

Coordination with Brgy.Captain in Brgy. Villa Cerveza ,Victoria Or. Mdo

COORDINATON with BRGY OFFICIALS AT PINAGSABANGAN NAUJAN OR. MDO

Coordination with Brgy. Captain in Brgy San Antonio

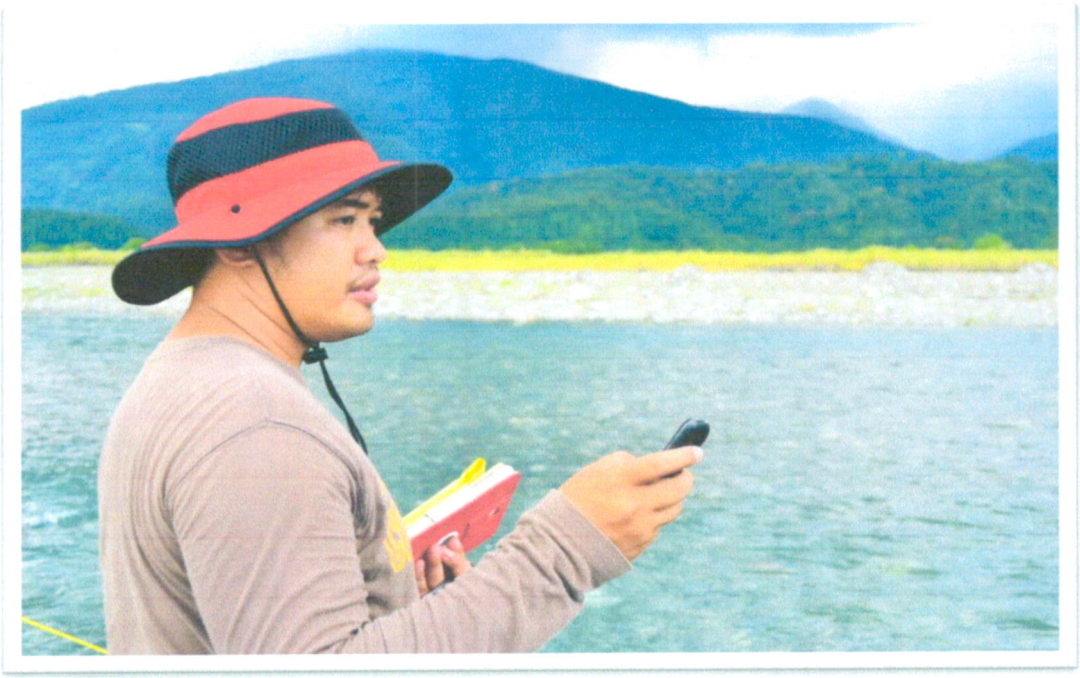
Coordination with Brgy.Captain in Pinagsabangan Naujan , Or. Mdo

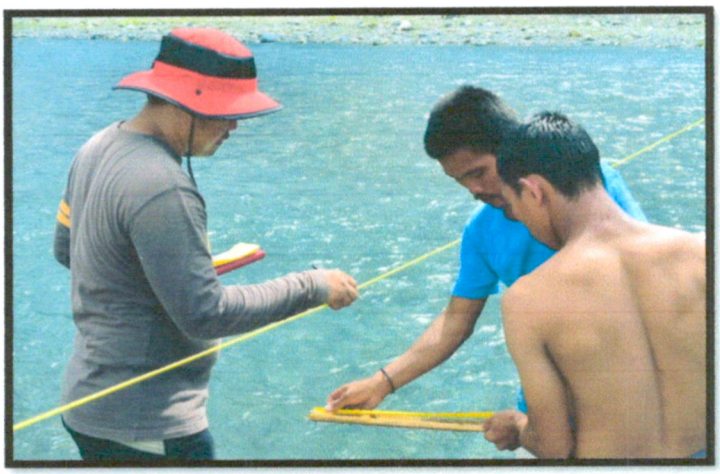
MAG- ASAWANG TUBIG WATERSHED

"STREAM FLOW MEASUREMENTS"

MEASURING
WATER LEVEL
using meter stick

Measuring water discharge of the river channel



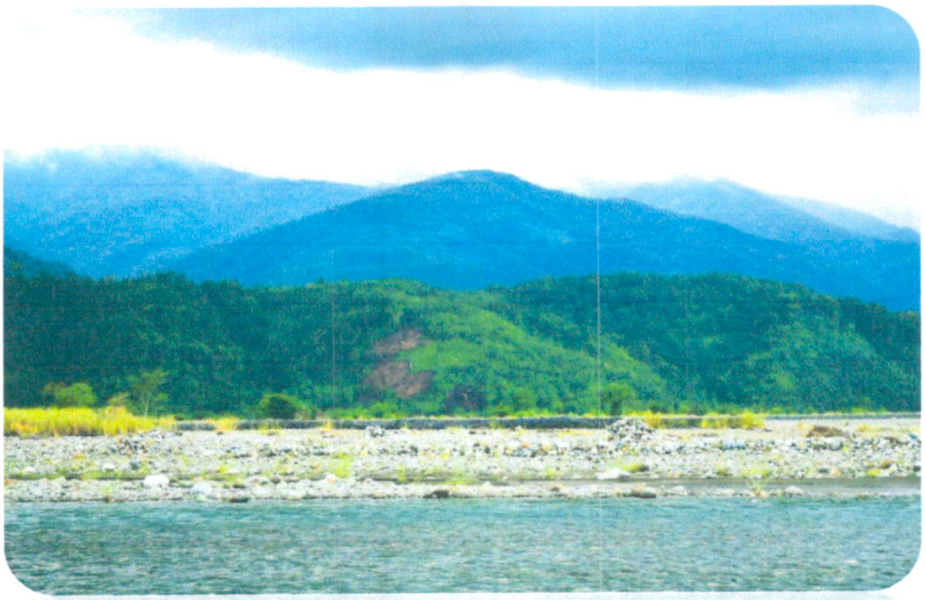


pictures shows actual measurement of water velocity

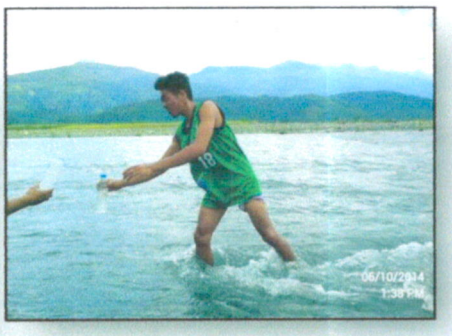
Measurement of water Discharge of Mag-asawang tubig River taken at Mid-section of the river located at Brgy. Pinagsabangan , Naujan. Or. Mdo.

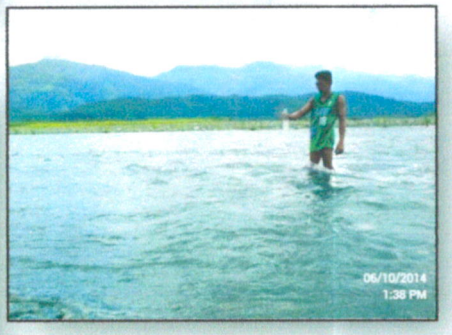

CRIMSON

Measurement of Water Discharge taken at the lower stream located at Brgy Pinagsabangan, Naujan Or. Mdo



MAG-ASAWANG TUBIG WATER SAMPLING





SOIL SAMPLING

INFRASTRUCTURE IN DIFFERENT BARANGAY WITHIN VICINITY OF MAG-ASAWANG TUBIG WATERSHED

KALINISAN


13°18'28"N, 121°19'36"E
accuracy: 6m
06/04/2014
2:28 PM


13°18'32"N, 121°19'26"E
accuracy: 4m
06/04/2014
2:25 PM


13°18'32"N, 121°19'26"E
accuracy: 4m
BARANGAY KALINISAN


13°18'33"N, 121°19'26"E
accuracy: 4m
06/04/2014
2:26 PM


KALINISAN ELEMENTARY SCHOOL
Teaching Force
MRS. JEZEL M. TUNGOL
MRS. ROSARIO M. DE LEON
MRS. DULCE T. DECIPEDA
MRS. JENNIFER M. ROMERO
MR. ALEX R. MALIHAO
MRS. GINA M. SALAZAR
MRS. CARINA R. DE RAMOS
LITA LORAIN MORENO, Ph.D
06/04/2014
2:29 PM

SAN ANTONIO


13°20'16"N, 121°17'57"E
accuracy: 12m
PAMAHALAANG BARANGAY
SAN ANTONIO
06/04/2014


13°20'19"N, 121°18'0"E
accuracy: 8m
SAN ANTONIO ELEMENTARY SCHOOL
06/04/2014
10:50 AM


13°20'19"N, 121°18'0"E
accuracy: 6m
06/04/2014
10:51 AM


13°20'16"N, 121°17'57"E
accuracy: 4m
PAMAHALAANG BARANGAY
SAN ANTONIO


13°19'33"N, 121°18'7"E
accuracy: 12m
06/04/2014
10:36 AM


13°19'33"N, 121°18'8"E
accuracy: 12m
06/04/2014
10:37 AM

ESTRELLA


13°19'52"N, 121°18'36"E


SIGARILYO
13°19'52"N, 121°18'36"E
accuracy: 12m


13°19'55"N, 121°18'32"E


13°19'46"N, 121°18'35"E
accuracy: 6m
LEON GARONG MEM SCHOOL

STA.CRUZ

POBLACION 1


13°19'29"N, 121°18'12"E
accuracy: 8m
06/04/2014
10:28 AM


13°19'27"N, 121°18'9"E
GO HEARTS
06/04/2014
10:24 AM


13°19'28"N, 121°18'9"E
accuracy: 6m
06/04/2014
10:25 AM


13°19'30"N, 121°18'9"E
accuracy: 8m
06/04/2014
10:07 AM


13°19'28"N, 121°18'9"E
accuracy: 6m
06/04/2014
10:24 AM

POBLACION 2


13°19'25"N, 121°18'21"E
accuracy: 6m

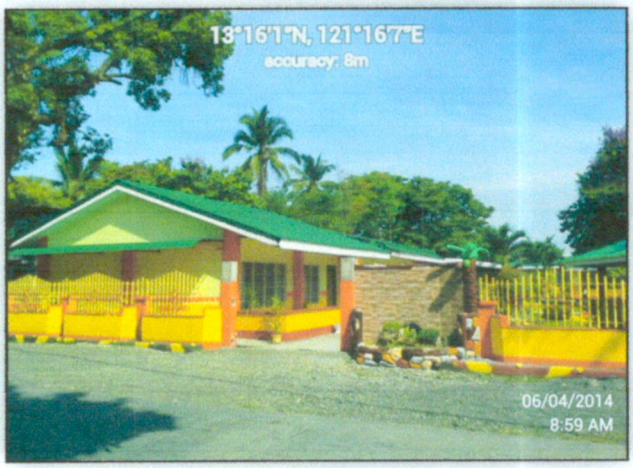

13°19'24"N, 121°18'25"E
accuracy: 8m
06/04/2014
11:56 AM


13°19'23"N, 121°18'25"E
06/04/2014
11:57 AM


13°19'26"N, 121°18'27"E
accuracy: 6m
06/04/2014
12:00 PM


13°19'19"N, 121°18'21"E
accuracy: 6m

PINAGSABANGAN



PIÑAHAN


05/30/2014
2:09 PM


13°18'12"N, 121°15'48"E
05/30/2014
2:14 PM


13°17'56"N, 121°15'45"E
05/30/2014
2:10 PM

ANDRES YLAGAN, NAUJAN

BACUNGAN

BARCENAGA


COMEHI
05/30/2014
1:49 PM


accuracy: 8m
05/30/2014
1:50 PM


13°16'20"N, 121°14'14"E
accuracy: 8m
Porfirio G. Comia
Memorial National High School
05/30/2014
1:50 PM


13°16'58"N, 121°14'40"E
accuracy: 8m

PINAGSABANGAN

BRGY. NAG-IBA HALL

NAG-IBA 1, NAUJAN

NAG-IBA 2


CHRISTIAN CHURCH
05/30/2014
2:45 PM


13°19'39"N, 121°16'32"E
accuracy: 8m
THIS LOT- DONATED BY
MULTI-PURPOSE CENTER

SAN CARLOS


05/30/2014
10:27 AM

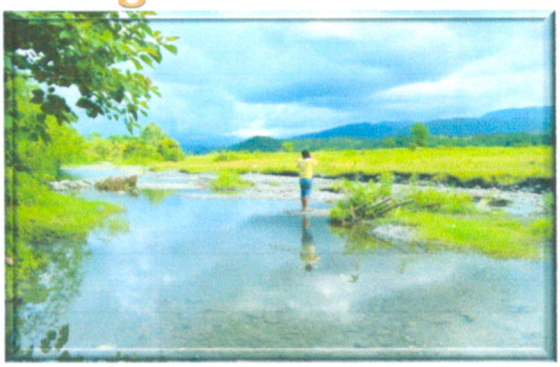

13°13'49"N, 121°14'27"E
PAMILIHANG ELEMENTARYA - SAN CARLOS
DONATED BY:
ANCE MANALO
BATO
05/30/2014
10:29 AM


SAN CARLOS ELEMENTARY SCHOOL
MULA KAY
HON. MAYOR ROMAR G. MARCOS
HON. VICE MAYOR WILSON VIRAY
SANGGUNIANG BAYAN MEMBERS
05/30/2014
10:28 AM


SAN CARLOS ELEMENTARY SCHOOL
DIVISION OF ORIENTAL MINDORO
05/30/2014
10:29 AM


PAMILIHANG ELEMENTARYA - SAN CARLOS
ALO
BATO
05/30/2014
10:30 AM

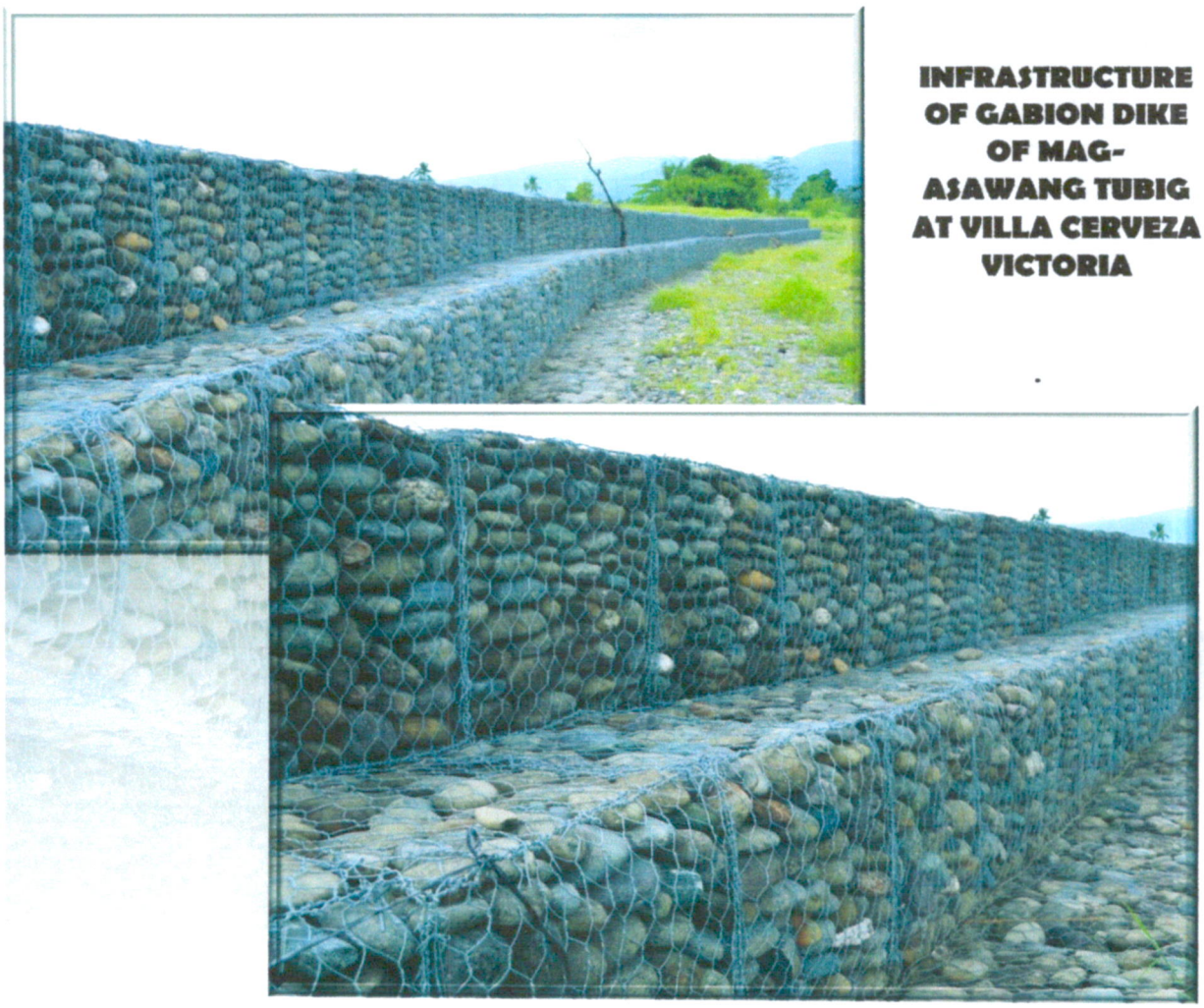
Irrigation




zep


20T
MAG-ASAWANG TUBIG BR.
KM 25 000


Gabion
Dike



INFRASTRUCTURE OF GABION DIKE OF MAG-ASAWANG TUBIG AT VILLA CERVEZA VICTORIA

Construction of Gabion Dike to prevent spill-over of excess water to adjacent Bucayao river that causes floodings at Calapan City during the occurrence of heavy rain.